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ELECTRIFICATION OF RAILWAYS.

Ever since the introduction of steam power cheapened the cost of hauling and thereby inaugurated a transportation business, on land, that had not been previously possible, the location and extent of railroads have been determined by the laws of supply and demand and of cost and earnings. This relation of railroad costs and earnings has been changed in important particulars by the development of electric-railroad apparatus. Railroads create their own business, the amount of which depends upon the facilities they offer and the charges they make, and it is generally conceded that the economies and improvements resulting from the use of electric power will lead to ever increasing railroad traffic and will be a great factor in the future of this work.

Much has been said regarding the electrification of steam roads. Among the notable contributions to the already voluminous literature on this subject may be mentioned the papers of Messrs. George Westinghouse, Wm. B. Potter, L. R. Pomeroy, F. W. Carter and H. M. Hobart, presented at the joint meeting of American and British mechanical engineers.

Excellent as the papers were there is no doubt that the difference between American and English conditions of working are such as to detract greatly from the interest and practical value of a joint discussion of this kind.

Mr. Westinghouse's paper put in a plea for the selection of a system of traction suitable for universal use; other papers by Mr. Potter, Mr. Carter, and Mr. Hobart compared the merits of the direct-current and single-phase systems of traction to the disadvantage of the latter—Mr. Hobart in particular claiming a saving of something like ten cents per train-mile in favor of the direct-current system for suburban service.

However, as Mr. Hobart's data for both the Brighton and Midland Railways' single-phase lines were disputed by the engineers of those undertakings, it would be premature to accept his conclusions as they stand.

It is somewhat significant that Mr. Dalziel, of the Midland Railway Company, held that main-line electrification is comparatively imminent, and his subsequent remarks as to the present limited capacity of certain important sections of the Midland company's system and the costly char-

acter of the work of increasing their capacity for steam seem to indicate that the electrification of the entire system is being seriously considered.

Continental opinion seems to be greatly in favor of the single-phase system, and a similar conclusion was reached at the International Railway Congress, held recently in Switzerland. While it must be admitted that the alternating-current motor is inferior to the direct-current motor in certain respects, there are many advantages of great moment in its favor, and the single-phase system is preferable under certain conditions. On the other hand, it seems as if direct current were preferable on railways having a heavy suburban traffic.

The results shown in these discussions only serve to illustrate what is very obvious on an inspection of the problem. In any proposition where so many factors are involved and the relative value of the factors is so variable nearly an infinite number of different solutions are bound to appear.

In this country we have the records of the New York, New Haven & Hartford, and the New York Central railroads to point to as examples of both single-phase and direct-current operation which are the most convincing testimony as to what has actually been done. And with the rapid development of suburban service, requiring larger power houses at terminals which can gradually be made sufficient for working the line on further stretches in each direction, until it may be desirable to electrify the whole division, the cause of electrification is steadily progressing.

DEPENDENCE OF RAILROADS ON ELECTRICITY.

The electrification of steam railroads progresses steadily, and electrical enthusiasts look to see the day when steam locomotives will be used only on long trunk lines or on lines with infrequent service, and, perhaps, for a certain amount of switching. But even where electric operation does not supplant steam for motive power the railroad has become dependent for its operation upon the electric current in numerous ways.

The first and most important use of current was for the telegraph line, which soon became an adjunct of the railroad, and was indispensable for train dispatching where high speeds were attempted. Today this form of dispatching has been largely supplanted by the telephone, which is becoming more and more widely used for this purpose. The transcontinental lines seem to be especially active in adopting this change, and the Atchison, Topeka and Santa Fé Railroad will soon have about seven thousand miles of telephone line in operation.

Electric lighting of trains has become very general in first-class passenger service, and the electric fan and the annunciator are found in nearly every Pullman car. In certain cases the entire train is lighted by means of current supplied from a generator and engine operated in the baggage car, steam being supplied from the locomotive. The more usual alternative is to carry a generator on the truck of each car, so that each becomes an independent lighting unit. This method is very general on Pullman cars. In order to keep up service when the car is not in motion a storage battery is carried on the car, and thus another electrical industry is introduced into railroading. The battery floats on the line, the generator being automatically switched in only after the car has attained a certain speed. On the locomotive the electric headlight is being widely adopted and has greatly extended the field of vision of the engineer. Some objections have been raised to a powerful headlight, but its use is nevertheless spreading.

Most of the systems of block signals in use utilize the electric current and it is safe to say that every automatic system is dependent upon this agency. It is evident that the safe operation of fast trains at frequent intervals would be utterly impossible without the aid which has been furnished by the electrical inventor.

AN "ELECTRICAL WEEK."

This week Chicago is holding a "Home Market Week." Under the auspices of that enterprising body of men, the Chicago Association of Commerce, the great stores of the city are exhibiting in their show windows the multifarious products made in Chicago. The chief idea in this exhibition is to foster a closer business relationship between the Chicago producer and retailer, for the good of the city.

This gives us an idea. Why not have an "Electrical Week?" True, there are yearly electrical shows in several of the large cities of the country, and many central stations have equipped "electric shops" and "electric homes" for advertising purposes, with beneficial results. But an "Electrical Week" on the lines of the "Home Market Week" would be more universal and popular, and would bring home to the people the benefits and advantages of electricity in a way much more effective than any other form of publicity that could be devised.

To particularize: It would be an evidence of the up-to-dateness of the manufacturer or retailer if he could announce "These premises are lighted and ventilated by electricity," "Our machines are electrically operated," "This dough was mixed by electricity, and was never touched by the human hand," "We keep the flies from this food by electric fans, from the time the materials are mixed until the finished product is sold," "Our food is cooked in an electric stove, no gas fumes contaminate it," and so forth. There are a million ways of showing forth the merits of electricity in all operations and for all purposes. Have a slogan, illuminate the store windows, advertise in the papers, and make the "Electrical Week" a thing to remember. Follow it up by careful and thorough solicitation. Above all, get co-operation. Let everybody take a hand, and we believe the results will be astonishing.

INCREASING OUR FOREIGN TRADE.

In a recent press dispatch from Washington, D. C., it was announced that the United States Government is about to inaugurate an extensive and comprehensive campaign for the betterment of American industrial and commercial trade with foreign countries. This, it is reported, will be undertaken under the direction of Secretary of State Knox by the State Department in conjunction with the Department of Commerce and Labor. *The Inter Ocean*, a Chicago daily, states on the authority of its Washington correspondent that the entire diplomatic and consular organizations of this country will be utilized, and that, in addition, a staff of six commercial experts of world-wide training will be attached to the Department of State to gather data and information of practical business value that might escape the notice of the consular officials abroad. The cost to the United States Government for this special service is given as $134,000 a year for the first few years, and it is further estimated that during a period of five years the resulting gain in our export trade should reach the enormous figure of $750,000,000.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of August 6 last, in an editorial entitled "Do We Advertise Enough," it was suggested that the Bureau of Manufactures (which is a bureau of the Department of Commerce and Labor) make an effort to keep our manufacturers and exporters informed of forthcoming expositions abroad so that American industry might be adequately represented in these foreign "show-windows." It is evident that the Washington officials are going much further than this, and it is to be hoped that the idea of co-operation with the manufacturers, which was also advocated in the same editorial, will be utilized to the full in the coming campaign.

There is every reason why this expansion of our foreign trade should be anticipated and felicitated. The natural resources of the United States are much greater than those of England and Germany, our greatest trade rivals. Our labor is cheaper, for, although a working man in this country makes about twice as much wages as the English or German workman, yet he produces four times as much, owing to the more up-to-date and economical methods employed here. The argument that American manufacturers can hardly supply home markets and do not want foreign trade, is absurd, for obviously, with an open world market and profitable foreign trade, additional capital for new factories would soon be attracted in sufficient volume to place the United States well among the foremost nations exporting manufactured goods. Develop the market, and the manufacturing and trade will follow. But the other nations have obtained a great start, and it is evidently the intention of the United States Government to point out the way to overcome this handicap. If the present administration can accomplish this thing its name will go down in history on this achievement alone.

As showing the activity of Great Britain in regard to her export trade, the following extract from a recent consular report is instructive: "As British manufactures constitute something over seventy per cent of the exports of British products, and as these are more or less illustrative, in form and quality, of American manufactures, it will be interesting to note wherein British manufacturers keep on increasing this great branch of British trade. While the exports of manufactures in 1910 were $118,287,553 in excess of those of 1909, they were only $57,144,711 greater than those of 1908, which may be called a normal year for British trade. It is a noteworthy fact in British trade that if, for any reason, the exports of manufactures should fall off in any year, there is an immediate effort made by the manufacturers to make up for lost trade, and the succeeding year is sure to see trade restored to its necessary status—steady and continuous increase. It is a matter of necessity, not choice. The vast industrial machinery of the United Kingdom forces British manufacturers to find new fields of exploitation, while keeping their old fields fully supplied. Good years and bad years have no meaning to the British manufacturers. They must, and therefore will, trade, even at immediate losses, depending upon the good times, which always come, for their compensation."

This aggressive spirit in export trade is one to be commended and copied. Although the United States does not, like Great Britain, depend on her foreign trade for her very existence, it is not to be denied that the establishment of a great export trade in manufactured goods will tend to make the country more and more prosperous and an even better place in which to live than it is at present.

KEEPING OUT THE FLIES.

Discriminating householders in these hot days will undoubtedly tend to patronize stores in which flies are conspicuous only by their absence, and in this connection the ingenious use of an electric fan by an enterprising baker in Chicago is worthy of mention. This tradesman, who occupies an attractive store on Milwaukee Avenue, has fitted a large electric fan in the transom above the entrance to his shop, so as to create a strong draft of air downward and outward across the street door. The flies are thus kept away from the screen door and so cannot obtain an entrance to the store every time a customer comes into or goes out of the shop. In the words of another baker who was just enough to note the value of the novel application and who will probably follow his rival's lead, "there was not a fly to be seen in the store."

The innovation is simple and extremely effective, and it should prove an excellent "dollar idea" for the electric-fan salesman. Thus another field of usefulness is opened up for the electric fan, and the practical hint recorded here should lead to still further openings for its successful exploitation.

New England Section of the National Electric Light Association.

The summer convention of the New England Section will be held on September 12, 13, and 14 at the Hotel Griswold, New London, Conn.

The programme includes a reception on Monday evening, a banquet on Tuesday evening, and an executive session on Wednesday afternoon. Tuesday afternoon will be devoted to an outing. At the morning sessions the following papers will be read: "The Advantages of a Uniform System of Rate Making," by Howard Corning; "Illuminated Advertising—Its Possibilities," by L. D. Gibbs; "Special and Decorative Street Lighting," by J. A. Hunnewell; "Opportunities," by L. J. Chase.

A special train will leave Boston on Monday at 3:00 p. m., connecting with the boat at New London at 5:30 p. m.

Vermont Electrical Association Meeting.

The annual meeting of the Vermont Electrical Association will be held at Brandon, Vt., on September 28 and 29. The invention of the electric motor will be commemorated on September 28 at Mr. Davenport's shop and his descendants will join the electrical men in holding exercises. A suitable tablet will be unveiled. The Vermont Historical Society and the local branch of the National Electric Light Association will join in the observance of Davenport Day.

On September 29 a barbecue will be held at Lake Dunmore.

Programme of Convention of International Association of Municipal Electricians.

The fifteenth annual convention of the International Association of Municipal Electricians will be held in the Convention Hall, Rochester, N. Y., on September 6, 7, 8 and 9. Headquarters will be at the Powers Hotel.

Rochester is making great preparations for the entertainment of visitors, and the exhibits are going to be large and varied. The following papers are to be presented:

"Wireless Telephone and Telegraph," John W. Kelly, Jr., Camden, N. J.

"Lightning Protection," Walter M. Petty, Rutherford, N. J.

"Mercury Arc and Other Rectifiers," H. G. Kennedy, Rochester, N. Y.

"Relation of the Telephone to the General Organization of Fire Department Service," H. C. Bundy, Watertown, N. Y.

"Underground Work," J. B. Yeakle, Baltimore, Md., and Clarence R. George, Houston, Tex.

"Modern Police Signal System," Jos. B. Smith, Rochester, N. Y.

"City and National Code Rules, and the Relation of the City and Underwriters' Inspectors," R. A. Smith, Norfolk, Va.

"Inductive Loads of Low Power-Factors," A. S. Hatch, Detroit, Mich.

International Exposition of the Applications of Electrical Energy in Railroad Service.

Announcement was made in these columns recently of an international exposition of the applications of electrical energy in railroad service to be held in St. Petersburg, Russia, under the auspices of the Imperial Russian Technical Society. It was originally intended to hold this during the coming autumn, but at the request of numerous firms it has been decided to postpone it until next spring to give more time for the preparation of exhibits. Otherwise the plans have not been changed. The date of opening has been fixed as April 15, 1911, on the Russian calendar, which date corresponds to our April 28. On this day also the control of the Russian railroads will pass into the jurisdiction of the Imperial Russian Technical Society.

Electric Railway Casualties.

The report of the Interstate Commerce Commission relative to railroad accidents for the first three months of the present calendar year shows a material increase in the number of persons killed and injured. During the first three months of 1910 the number of persons killed on electric railways throughout the country was nineteen, and the number of injured, 669; and this is but a very small fraction of the loss of life and injury reported for the steam railroads of the country for the same three months.

For the steam roads the number of persons injured during January, February and March of the current year was 21,232, as against 6,110 in the corresponding three months for 1909, and the number of persons killed, 1,100 as against 466 in the same period of 1909. These figures deal only with employees on duty and passengers, and take no cognizance of trespassers.

Attention is especially called to the fact that the number of casualties for the quarter above referred to were materially swelled by two great disasters, the avalanche in the state of Washington, and a derailment in Iowa.

Chicago Consolidated Traction Situation Clearing Up.

The long drawn out reorganization of the affairs of the Chicago Consolidated Traction Company is nearing completion. The reorganization plan calls for a foreclosure of the property by the bondholders and its transfer to the Chicago Railways Company. A city ordinance authorizing the latter company to acquire the property and unexpired franchises of the Consolidated system, to rehabilitate the entire lines (128 miles of single track) within eighteen months and twenty-nine miles of this before February 1, 1911, and to put the valuation of the present property at $4,000,000 is now being drawn up; it has the approval of the Chicago Railways Company and in all likelihood will be passed by the city council within a few weeks. The Consolidated lines form the outlying feeders of the Chicago Railways Company's system and when acquired by the latter will give it complete control of the surface traction line on the north and west sides of the city. The projected reorganization and disposal of the Consolidated system has the approval of the court and receivers in whose hands the property now rests, and it is likely that the receivership of the Chicago Railways Company will also be terminated thereby, because it was brought about by the involved relations of the two companies.

Tunnel Under Chicago River Completed.

The rehabilitation of the Van Buren Street, 1,800-foot tunnel under the Chicago river between Franklin and Jefferson Streets has been practically completed. President Roach of the Chicago Railways Company is quoted as stating that the tunnel will soon be ready for use by all cars now crossing the Van Buren Street bridge. It will be necessary, however, to remove some pillars of the elevated structure before the long cars can turn the corner at West Van Buren and South Clinton Streets.

E. W. Caldwell.

The attempted assassination of Mayor Gaynor of New York City as he was about to leave Hoboken, N. J., for an ocean trip, and the subsequent examination and diagnosis by means of the Crookes tube has brought into prominence a modest worker in this peculiar field of physics, Dr. Eugene Wilson Caldwell. There was a time not so long ago when the application of the X-ray for therapeutic diagnosis and research was heralded with loud acclaim and much ado made over the most trivial circumstances connected with this sort of work. So great has become the usefulness of the Crookes tube in therapeutic diagnosis that it is an every-day occurrence in all our large clinics, and X-ray operators are among the busiest of our skilled adjuncts to the medical profession.

E. W. CALDWELL,
Who Made the Radiographs of Mayor Gaynor's Wound.

What has made the use of the X-ray in therapeutic diagnosis so successful and so widely used? Nothing but the painstaking, conscientious and heroic application of men, who, like E. W. Caldwell, have been gifted with remarkable attributes and have mastered the control of this peculiar force for the benefit of suffering humanity. In his work as chief of X-ray diagnosis for several important clinics in New York City, and in his private practice as an expert in the handling of X-ray apparatus, Dr. Caldwell has worked out many ingenious and valuable appurtenances connected with the X-ray apparatus. He has achieved great success in shortening the exposure period and in developing protective devices, so that today both operator and patient are guaranteed immunity from the burn which ten years ago caused so much distress in operations of this character.

Eugene Wilson Caldwell is an electrical engineer. He was born at Savannah, Missouri, December 3, 1870, a son of W. W. and Camilla (Kellogg) Caldwell. He was graduated from the University of Kansas with the degree of Bachelor of Science in 1892, and from New York University and Bellevue Hospital Medical College with the degree of Medical Doctor in 1905. In 1904 and 1905 he was engaged in experimental work on telephoning to light ships from the United States Lighthouse Establishment. In 1895 and 1897 he was connected with the engineering department of the New York Telephone Company. Since that time he has devoted himself to original work in wireless telephony, induction coils and interrupters, Crookes tubes, and especially in the application of the Roentgen rays to diagnostic and therapeutic uses. He is the author (with Dr. W. A. Pusey) of "Roentgen Rays in Therapeutics and Diagnosis," and he has been a prolific contributor to the technical press. He is an associate of the American Institute of Electrical Engineers, and a member of the American Roentgen Ray Society, the Roentgen Society of London, the New York Electrical Society, the New York Club, Phi Beta Kappa, Sigma Xi and Nu Sigma Nu.

Dr. Caldwell has won the confidence of his colleagues in the medical fraternity by his absolute knowledge of what has been considered by many to be one of the most peculiar of the abstract sciences. He has devoted himself unstintedly to the development of the art of radiography, and he merits the commendations which have been showered upon him. He is possessed of a most delightful personality, and beyond his attainments in his chosen field he is for himself a good man to know.

Magnetic Properties of Alloys.

At the meeting of the Royal Society of Edinburgh on June 20, a paper was read by A. D. Ross and R. C. Gray on the magnetism of copper-manganese-tin alloys under varying thermal treatment. The alloys prepared contained 14, 16, 18, 30, 38, and 48 per cent of tin, the remainder, copper and manganese, being in the ratio of seven to three. At fifteen degrees centigrade, these alloys gave, when subjected to a field of 100 units, intensities of magnetization, respectively, of 55, 77, 82, 0.4. 96, and 1. Thus the thirty-eight-per-cent alloy forms a group by itself, marked off from the group of lower percentages by the thirty-per-cent alloy, which has very small susceptibility. The critical temperatures varied from 225 to 275 degrees centigrade. In the case of the thirty-eight-per-cent alloy, the critical temperature was 225 degrees, on cooling from which the alloy regained its magnetic quality, but when heated to 330 degrees it did not regain its magnetism on cooling. Many other results were detailed in connection with thermal treatment of various kinds.

A large field for research remains to be explored, and further experiments may be expected.

New Public Service Commission Appointment.

A chief is to be appointed some time in September to take charge of the telephone and telegraph division of the New York Public Service Commission, second district. All clerical positions under the head are to be appointed from the state civil-service list. I.

New Cuban Electric Railway.

The Cienfuegos, Palmira & Cruces Railway and Power Company has started construction on the roadbed within the city limits of Cienfuegos, Cuba. Its lines will run through the principal streets of the city, and its surburban extension to the towns indicated in the title of the company, thus opening up all available land for suburban residences, of which the city is in need, and a vast territory of rich farming land, which as yet has little or no communication with the city.

The company is American, the concession including all the water rights of the Hanabanilla River, where the electric power will be generated. All material used in the construction of both the new waterworks and sewerage system and the electric railway comes from the United States, such as vitrified-clay sewer pipe, iron pipe, rails, cars, electric appliances, machinery, etc.

Decision in Montgomery Light Case.

Judge Thomas G. Jones in a lengthy opinion handed down in the Federal Court for the Middle District of Alabama, on the afternoon of Tuesday, August 2, holds that Alexander Rice and F. S. Ball, formerly president of the Citizens Light and Power Company and attorney for Mr. Rice, respectively, are not guilty in contempt in transferring the stock of the Citizens Company to Richard Tillis in the face of an injunction which had been secured by Henry L. Doherty Company restraining the transfer of such stock. Judge Jones, however, holds that the complainants are justified in the suit and assesses the costs against Messrs. Rice and Ball. The decision is based upon the demurrrer to the effect that Mr. Rice was not informed of the issuance of the injunction and that Ball could not be considered technically a party to the suit.

With respect to the injunction restraining the selling of the stock which it is alleged Mr. Rice had contracted to deliver to Henry L. Doherty Company, Judge Jones holds that the contractual relations are valid and that the injunction be maintained so that existing status relating to the possession of the stock can be given a final hearing and decision after the submission of the facts.

Government Hydroelectric Plant on the Hudson.

Plans of the Federal Government for the construction of a concrete dam across the Hudson River at Troy in connection with the barge canal terminal, will greatly broaden the industrial possibilities in that city and in Green Island, as the result of the destruction of the present system of hydraulic power used by the factories and mills at the present site of the dam. A hydroelectric powerhouse is to be erected on the west side of the river at Green Island which will use the flow of water on the dam and generate approximately 6,000 horsepower. By transmission lines this power will be available not only for the present industries on the Troy side of the Hudson River, but will also offer exceptional advantages to other industries both in Troy and Green Island.

The amount of electrical energy thus generated is equivalent to a threefold increase compared with the present hydraulic power. This electrical power will be sold to consumers by the National Government at the cost of production, or about a third of the cost of the power generated at Niagara Falls. It is explained that it will also be necessary for the companies using the power to meet the cost of the powerhouse to be constructed.

The United States Government has prepared for the erection of a dam which will extend across the Hudson River for a distance of 1,100 feet to be built of cement and stone from the rock bottom in the bed of the river to a height equal to that of the crest of the present dam. Roughly estimated, the expense of the Federal Government's improvement will be $1,300,000.

Steady Progress in Italian Hydroelectric Development.

Continued activity is noted by United States Consul John Q. Wood, of Venice, in the exploitation of new hydroelectric plants of North Italy. He cites some examples as follows: Work is progressing rapidly on the 9,000-horsepower works at Ponte della Serra in the Province of Belluno, under the direction of three electrical companies. The Milani hydroelectric plant, producing 100,000 horsepower, was inaugurated in November, near the city of Verona. The electrical equipment was supplied by the French Westinghouse Company of Havre. Electric car lines are springing up in all parts of this district, enormously stimulated by the cheap electric power. The state frequently sudsidizes these companies, as in the case of the line from Belluno to Pieve di Cadore, which will receive $115 per kilometer.

Improving Portability of Standard Cells.

A method for making Weston standard cells less liable to disturbance during transportation is described in *The Electrician* for July 15 by H. Tinsley. After filling the separate limbs, tightly-fitting rings of cork are prepared, and to these are sewn disks of unbleached linen, freed from all chemical impurities. These drumheads are forced firmly on the solid matter and will hold the chemicals in position even with violent handling. There is a constriction in the glass limbs, and the sulphate is filled in to this point.

The linen screen does not affect the electromotive force, and as it becomes saturated with the solution, its resistance remains low. It also affords a fairly free passage for solution. The internal resistance of these cells is about 750 ohms, and is more uniform than with a crystal plug, as used at the National Physical Laboratory.

Santa Fé Dispatching System.

On the Atchison, Topeka & Santa Fé Railway system there are now in operation 3,004 miles of dispatching circuits and 2,645 additional miles are under construction. There are also 285 miles of second dispatching circuits in use and 158 more miles of such circuits being built. With 875 miles of joint railway and commercial telegraph circuits, the total mileage of the Santa Fé dispatching system will soon be 6,969.

Duty on Wireless Photographic Apparatus.

By a recent ruling of the Board of United States General Appraisers, instruments for the wireless transmission of photographs have been held to be dutiable at forty-five per cent of their value. Protest was made that the apparatus was for experimental purposes and therefore not dutiable, but the protest was overruled.

Electrical and Mechanical Installation in the Blackstone Hotel.

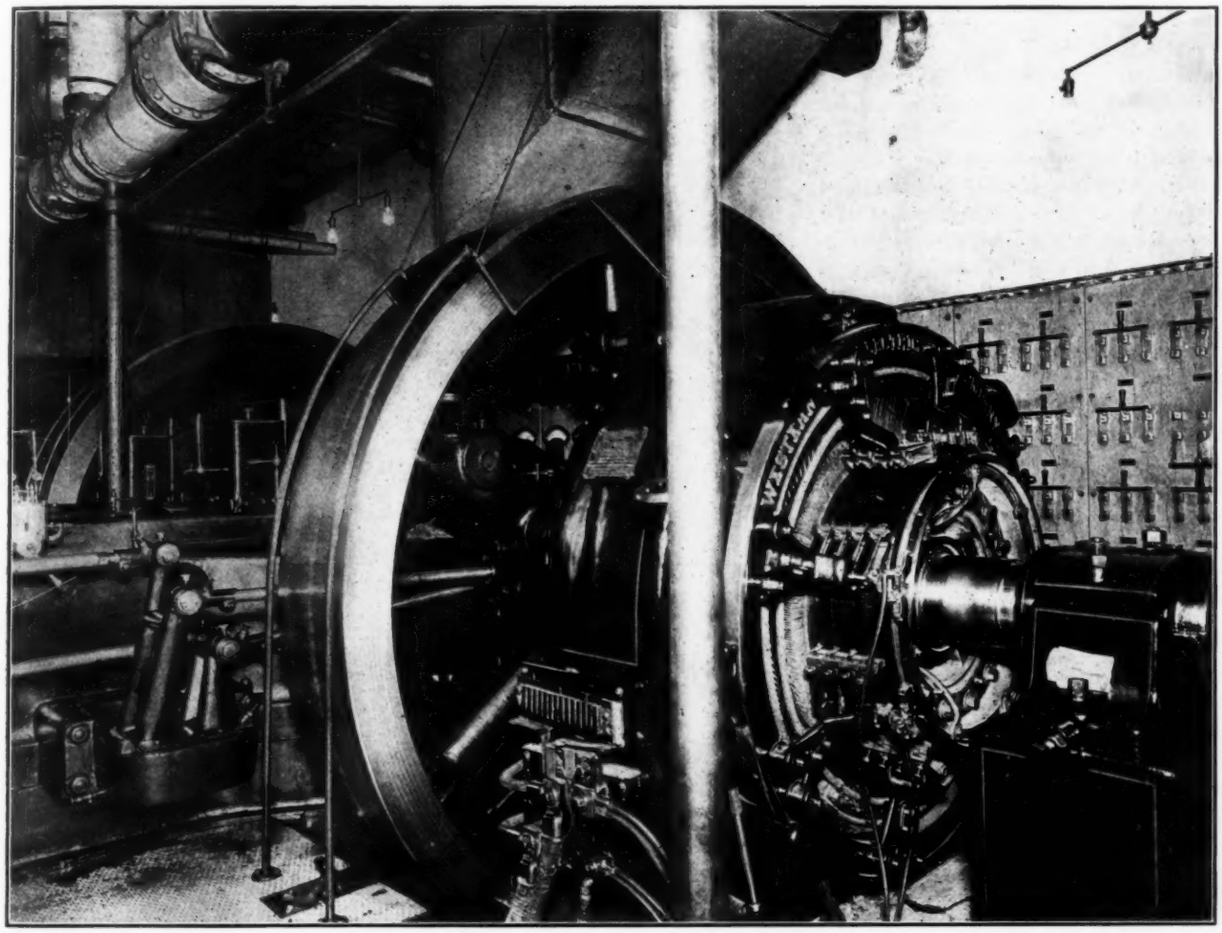
Description of One of the Most Complete Equipments in Private Service.

The new Blackstone Hotel, which has recently been opened at the corner of Michigan Avenue and Hubbard Court, Chicago, forms an important addition to the city's hotel facilities, and from an architectural point of view adds much to the growing line of magnificent buildings along the lake front. The hotel is a first-class modern fireproof structure in every detail, and will afford accommodations which are nowhere excelled. The location is ideal for such a building, quiet though central, and possessing an unobstructed outlook over the broad boulevard and Lake Michigan beyond.

The Blackstone fronts eighty feet on Michigan Avenue and 173 feet on Hubbard Court and is twenty stories high or 287 feet from the sidewalk to the top of the mansard roof. It contains 450 rooms. The exterior of the building is gracefully proportioned and is finished in such a manner as to be especially pleasing. From the sidewalk up to a height of six feet it is finished in pink granite. From this level to the third floor the facing is white terra cotta with attractive ornamental work around the wide arched windows and entrance on the main floor. Above the second floor the facing is a rich cherry-red pressed brick with white terra cotta around the windows, in small balconies and in the cornice. The roof is of green tile with white terra cotta trimmings.

The interior finishing and furnishing of the hotel is in keeping with the beautiful exterior and from an engineering standpoint, the heating, lighting and various power applications represent the most modern practice.

The power plant is located in the basement on a level twenty-eight feet below the street. The general arrangement of a portion of the apparatus is shown in the accompanying view.



VIEW OF GENERATORS IN BLACKSTONE HOTEL.

The boiler room is located in the southwest corner of the power plant and is partitioned off by a brick wall. The boiler equipment consists of four 250-horsepower Stirling water-tube boilers in single settings, located in a row along the north wall. Each boiler is equipped with a McKenzie chain grate stoker operated by a two and a half horsepower motor.

Coal is brought in through a sub-base-

ment connection with the freight-tunnel system of the Illinois Tunnel Company and complete facilities are provided for the automatic handling of the coal from the tunnel cars to the stokers. The conveying machinery is of the Stephens-Adamson type. Provision is made for dumping ashes directly into tunnel cars or conveying them to the street to be removed by wagon.

The chimney extends 328 feet above the grate bars. It is of steel construction, with an elliptical section six feet by seven feet in diameter. The breeching and stack are lined with Johns-Manville vitrobestos.

Just outside of the boiler room entrance there is installed one Wainwright feed-water heater. All pumps installed in this hotel are of the single-cylinder type and were supplied by the American Steam Pump Company. All steam mains of three inches and above have welded flanges and Nelson valves.

In the engine room, directly west of the boiler wall there are installed three generating units consisting of Ball four-valve engines, direct connected to Western Electric direct-current generators. The unit adjacent to the west wall of the plant is rated at 300 kilowatts and the other two at 200 kilowatts respectively. The generators are wound for 250 volts and are connected on the three-wire system.

East of the boiler room there are installed four house-service pumps, located in a row. The height of the building is such that it was deemed advisable to divide the water-supply system into two sections. The upper floors, therefore, have a high-pressure system and the lower floors a low-pressure system. The upper floors are fed by gravity from large enamel-lined tanks on the roof, and the lower floors are supplied by direct upward pressure. However, provision is made to supply the entire building with the high-pressure system in case of fire.

Heating is accomplished by both direct and indirect means, exhaust steam from the engines being used. The vacuum system is used and by this means all water of condensation is returned to the power plant. By the indirect system the air is heated in the power plant and is forced through large ducts to the compartments heated. The Illinois Engineering Company installed the vacuum system of direct heating.

The switchboard in this hotel is a model of its kind. It is located just north of the generators and against the enclosing wall of the generator room. The board is of the self-supporting angle-iron frame type and was furnished by the J. Lang Electric Company, Chicago, Ill. It consists of fourteen panels of pink Tennessee marble about two inches thick. There are three machine panels, one totalizing panel, for the station, six lighting panels and four motor panels. The board is equipped with the latest regulating and controlling apparatus.

The busbars are so arranged that the lamp and motor circuits can be operated separately or together, the lighting at 110 volts and the motors at 250 volts, and any machine can be connected either to the lighting circuits or to the motor circuits.

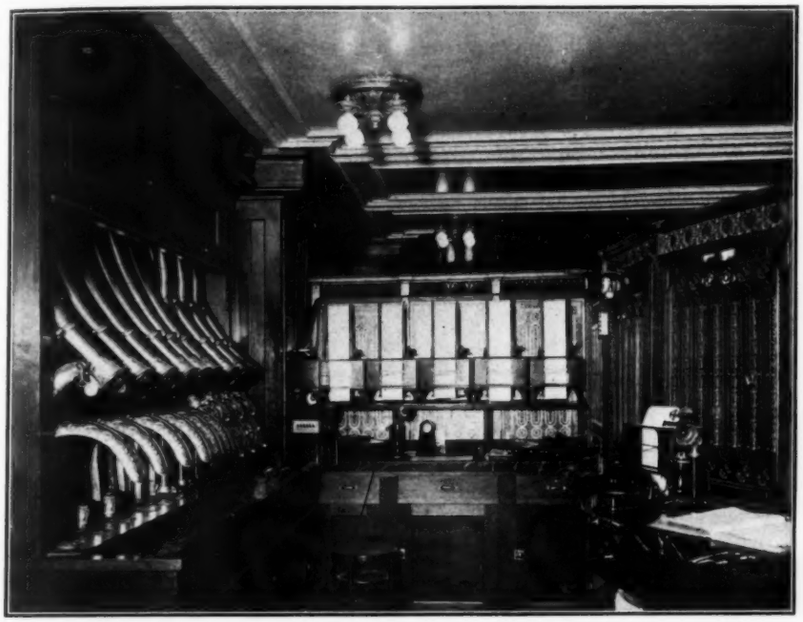
Included in the equipment of this hotel is a complete refrigerating installation consisting of two carbonic-acid compressors of fifty and 120 tons capacity driven by Murray rolling-mill engines. These machines are placed in a line with and east of the generators. The smaller machine is used for manufacturing ice and refrigerating purposes and the larger machine provides the air-cooling for cafes, restaurants and banquet halls in summer.

BLACKSTONE HOTEL, CHICAGO.

A complete set of ice-handling machinery such as an ice breaker, ice-cutting machine, ice-shaving machine, ice-cubing machine and ice-cream freezers is included in the refrigerating equipment and all of these machines are driven from one shaft operated by a fifteen-horsepower motor. The centrifugal pumps for circulating brine and water in the refrigerating system are also operated by motors. All of this

equipment is located in the power plant in such a manner as to occupy the smallest amount of space possible.

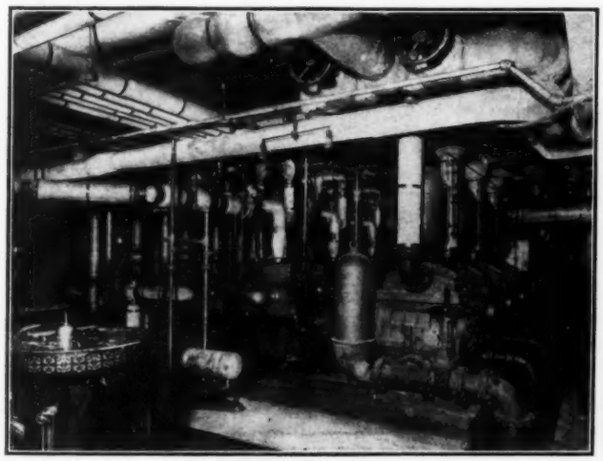
A ventilating system complete in all of its details has been installed in this hotel. Various rooms are equipped for an entire change of air at certain intervals while a number of the large public rooms are equipped to be supplied with artificially cooled air.



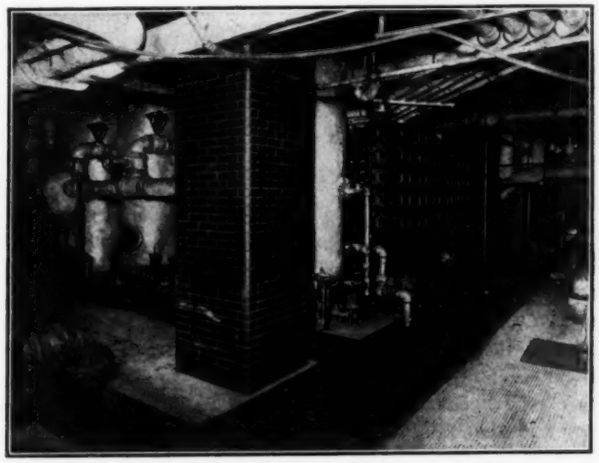
TUBE CLERK'S ROOM.

The kitchen and service pantries have a separate ventilating system with a separate air stack extending to the roof. The foul air from the rooms is exhausted through a separate system. All exhaust fans for the ventilating system are located on the upper floors and are driven by electric motors. The forced-draft fans for the indirect heating and for ventilation are placed in the basement in about the center of the engine room.

A completely equipped vacuum cleaning plant is installed and may be seen in the northwest corner of the basement. A cycloidal blower in the basement, driven by a seven by seven inch vertical steam engine is connected to the piping system consisting of four risers going up through the entire building in four different locations. There are connections on each floor with each of the risers so that all parts of the building may be easily reached for cleaning.



VIEW OF PUMPS IN POWER PLANT.



REFRIGERATING COILS.

The main entrance of the Blackstone on Hubbard Court leads into a roomy lobby seventy by seventy-five feet. Directly facing this entrance are the elevators, the desk, checkrooms all being back of these.

The elevator equipment of the Blackstone Hotel is somewhat unipue inasmuch as owing to the peculiar conditions existing in the building it was found necessary to make the nine elevators and lifts in this building of five different types, combining both the electric and hydraulic methods of operation.

The four principal elevators traveling from the Club Room level to the nominal sixteenth floor, making twenty landings, are of the electric type, using the gearless traction type of machine, installed overhead. These elevators have a travel of about 245 feet and a capacity of 2,750 pounds, at a speed of from 500 to 550 feet per minute. The high speed and great facility in operation of these elevators are made possible by the peculiar type of machine employed. This machine is essentially a very large slow-speed motor, having the traction sheave mounted directly upon the armature shaft, the cables passing over this driving sheave and idler sheave from the car to the counterweight in such a way as to give two half wraps on the driving sheave. The great ease and promptness of stopping and starting is accomplished by this direct application and the very slow speed of the armature, which is about sixty-five revolutions per minute.

The two service elevators, traveling from the basement to the nominal seventeenth floor and making twenty-five landings, are also of the electric type, using worm gear traction machines overhead. These machines have the same

traction features as the machines used with the passenger elevators, but employ the usual high-speed motors and worm-gear reduction, similar to the ordinary drum type of apparatus.

With each of these six elevators, the electrical car switch control is employed and each elevator has six mild-steel lifting cables. The weight of these cables is compensated for by means of chains on the service elevators and a special flat cable on all passenger elevators, in both cases one end of the chain or cable being attached to the counterweight and the other to the car.

The other three elevators in the hotel are of the hydraulic plunger type and comprise one Ball Room elevator; one supply elevator, and one sidewalk lift. This type of apparatus was adopted on account of the practicable impossibility of installing electrical machinery under the conditions prevailing.

For operating the hydraulic elevators there is installed in the basement a pumping plant, consisting of two single compound pumps, American type, furnishing water at a pressure of 175 pounds per square inch, and in connection with these pumps a main and auxiliary pressure tank, and also an open discharge tank, together with the necessary air pumps, hydraulic piping and a complete equipment for a first-class hydraulic elevator plant.

All the elevators are provided with the most modern type of steel tee guide posts, with corresponding style of safety devices, with extra emergency safety levers, in connection with passenger elevators.

The promoters of the Blackstone Hotel have spared no expense in providing for the utmost speed and accuracy in the fulfillment of the orders of its patrons and in this connection electric dumb-waiters and an elaborate telautograph system have been installed.

Two Burdett-Rowntree dumb-waiters, each operated by a seven and one-half-horsepower motor, extend from the first floor to the eighteenth floor. The motors are placed above the shaft. The operation of these dumb-waiters is under the control of a dispatcher in the kitchen. If an attendant in any one of the service pantries wants an elevator he pushes a button which lights a lamp at the dispatcher's station in the kitchen. On receiving the signal, the dispatcher presses a numbered push-button which sends the dumb-waiter to the floor from which the call originated. The dispatcher in the kitchen is at all times aware of the position of a car, the system being equipped with a lamp-signal device. For reasons of safety, the cars cannot be operated unless all of the doors in all shaft openings are closed.

The telautograph system installed is particularly interesting as it is said to be the most complete and comprehensive system ever put into a hotel. There are twenty-six instruments located in the various offices of the hotel and in each

GENERAL VIEW OF MAIN LOBBY, BLACKSTONE HOTEL.

of the service pantries on the upper floors. In connection with the house telephone service, the telautographs will be used to keep a direct record of orders transmitted in the routine of hotel service.

Telephones are installed in every room and department of the building, aggregating about 450 instruments. On the fifth floor there is provided a specially fitted telephone room in which is installed a special three-position Western Electric switchboard. This board was immeditely transmitted to the proper department by means of the telautograph. After being filled it is dispatched, through the pneumatic tubes to the nearest service pantry, and sent to the guest.

On the main floor, leading off the lobby is a cafe, fifty feet square. A wide stairway leads up to the mezzanine floor, six feet above the lobby, where the main dining room is located. This room is forty-eight feet by seventy-eight with a twenty-six foot ceiling. There are no interior columns in this room,

The kitchen is equipped with every known device to make it ideal. A wide use is made of a number of electric motors, they being employed for operating silver-polishing machines, dish-washers, dough-mixers, vegetable parers, etc. A dish-hoist for conveying dishes from the cafe is operated by a five-horsepower motor. Electric toasters are also extensively used in this kitchen.

The third floor is almost entirely occupied by what is called the art hall. This hall will serve as a place of enter-

VIEW OF MARBLE ROOM SHOWING INDIRECT LIGHTING UNITS.

manufactured so that the telautograph keys could be attached, thus making the joint service as efficient as possible. Further record is kept of the execution of all orders by the use of an extensive, electric time stamp system.

A pneumatic tube system is also a feature of the hotel service. Three-inch tubes are installed to carry small packages between the various departments of the hotel. When an order is received by the telephone operator, from a guest, it is with the result that the hall has a spacious air.

On the second floor above the main dining room is the banquet hall. This is similarly proportioned to the dining room, with high ceiling and is also free from columns. A departure is made from usual hotel practice in placing the kitchen on this floor. This arrangement is a great advantage in that there is almost direct communication with the dining rooms and banquet hall.

tainment for the guests. There is an art gallery 116 feet by twenty-five feet, private dining rooms, and other rooms for the general use of the guests. The paintings, tapestries and other decorations make this hall decidedly attractive.

The guest rooms of the hotel are located entirely above the third floor and are about 425 in number. Most of the rooms are fifteen feet by twenty-four feet. All rooms are provided with large closets and private connecting baths.

In each guest-room there is an artistic central ceiling chandelier for the general lighting, and in addition a portable reading lamp placed on a table. Each dresser is provided with two lamps fastened to the article of furniture itself and connected by flexible cable to baseboard outlets. By this means the dresser with its lamps can be moved about as desired.

Two electric lights are placed in each bath-room and they are mounted on rods and so arranged that the person using the mirror can raise or lower the lights to a suitable height.

A feature of the guest-room lighting is the automatic control of the lamps in each room. For this purpose each corridor door is equipped with a door-switch installed in the keeper of the door lock. The regular push-button switch installed in the room has an electro-magnetic attachment controlled by the door-bolt switch. Locking the door on the outside extinguishes the lights, but locking or unlocking the door on the inside does not affect them. When the room is occupied the lights are entirely under control of the occupant, by using the room switch. This arrangement not only affords convenience to the guests but will in all probability be the means of saving much current.

For the lighting of the entire building it is estimated that there are between 9,000 and 10,000 incandescent lamps used. While a large majority of these are tungsten lamps, some are tantalum and some the ordinary carbon-filament lamps. Throughout the various public rooms there are many beautiful fixtures and a few instances of indirect illumination. Particularly in the banquet hall and main dining rooms are the fixtures of exceptional artistic and mechanical value. Immense electroliers are suspended from the ceilings and these are supplemented by artistic wall brackets and floor-standards in keeping with the decorations of the rooms.

In the barber shop, buffet, private offices, Grecian marble room and kitchen and bakery the indirect system of illumination has been installed with excellent results.

In the barber shop every modern contrivance has been installed. The ceiling in this room is in the shape of a dome, the center portion being flat, and painted a pale blue. The curved part of the room is latticed, the colors being pale blue and white. The lighting is provided for by six fixtures each containing five 100-watt, clear-bulb tungsten lamps equipped with X-Ray reflectors. The fixtures are of the shallow bowl type, the bowls being suspended by chains from each ceiling outlet.

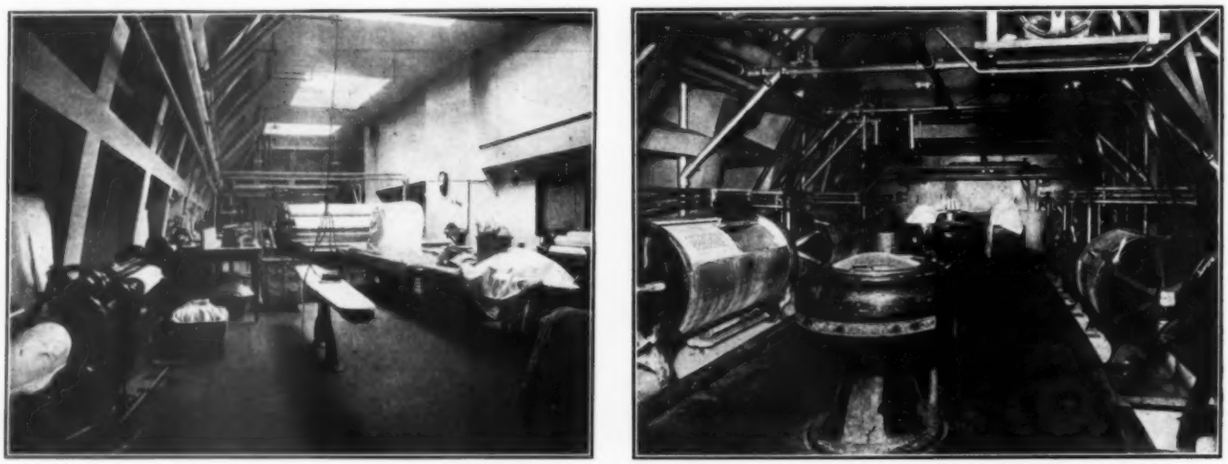
The ceiling of the buffet is divided into numerable small panels and is grayish white in color. There are 109 ceiling outlets, one located in the center of each panel. At each outlet a sixty-watt, clear-bulb tungsten lamp, with the tip projecting downward into a specially designed reflector is used.

In the Grecian marble room, shown in an accompanying illustration, six large bowl-like fixtures are suspended from the ceiling by artistic bronze chains. Twenty indirect-lighting reflectors are contained in the bowls of each fixture, and each reflector contains a sixty-watt, clear-bulb tungsten lamp.

The kitchen and private offices of the hotel are also provided with indirect lighting, all of which has been installed by the National X-Ray Reflector Company, Chicago.

The exterior lighting of the building has also received due consideration. A feature of this installation is a row of thirty-one standards along the roof line. Each of these standards supports a cluster of four forty-watt tungsten lamps. Running around the third-floor level there is a further line of thirty-six similar clusters which forms a lower line of light. The porte cochere on the Hubbard Court side of the building is lighted by twelve-lamp clusters.

On the twentieth floor of the building well removed from the rest of the hotel is the laundry which is a model plant in every respect. All classes of work are handled in this plant and in all of the various operations electric motors are used entirely. An extensive use is also made of electric heat.



TWO VIEWS IN LAUNDRY SHOWING ELECTRIC IRONS AND MOTOR-DRIVEN APPARATUS.

There are six washing machines installed in the laundry, three large and three medium size machines. The former are driven by a seven and one-half-horsepower motor and the latter three by a five-horsepower motor. A desirable feature of this arrangement is that either the large or smaller machines can be used, according to the demand.

The driers are of the conveyor and sectional type and each is driven by a one-horsepower motor. The wringers are each driven by a two-horsepower vertical motor. There is one large flat-work ironer installed, driven by a two and one-half-horsepower variable speed motor.

Other machines include a collar-and-cuff starcher, shirt starcher, band

starcher, shirt ironer, body ironer, collar-and-cuff ironer, band ironer, sleeve ironer and an underwear ironer. Motors varying in size from one-eighth to one horsepower drive individually and by direct connection all these machines. A number of the small ironing machines are electrically heated.

In the entire building the output of electric motors, ranging in size from one-eighth to forty horsepower, aggregates 450 horsepower. In addition to the motor applications already mentioned there are motors used to operate two revolving doors at the street entrances.

The revolving wings for both entrances are constructed of bronze and are of the collapsible, panic-proof type. They are furnished with a motor outfit placed over the tops of the doors in such a maner that the revolving wings may be folded and removed to one side of the opening. The electrical outfit can be arranged in such a manner that an attendant at the door can, at will, by the pressure of a push-button, start or stop the door. The motor used is a one-fourth-horsepower, shunt-wound Roth motor. It drives through a five-eighths round twisted endless belt running from the grooved motor pulley over two idler pulleys, which change the horizontal-shaft drive to a vertical drive. The driven pulley is geared to a spur gear on the door to revolve it at a maximum of seven revolutions per minute. A speed regulator is provided for reducing the speed if required. By lifting the center gear out of mesh with its driver, the door is allowed to operate perfectly free.

The silent system for calling carriages and automobiles is another feature of the electrical equipment of the Blackstone. The calling is done by electric signals installed by the Chase Electric Company, Chicago.

On each end of the porte cochere at the Hubbard Court entrance there is a nest of specially arranged receptacles, concealed by a leaded-glass face. Controlling wires run into the lobby of the hotel to a typewriter-like switchboard having three banks of keys. To operate the call, the keys on the keyboard are pressed and corresponding numerals flash on both signs. By pressing a key to the left of the keyboard, the contacts are released and the numerals disappear.

All of the motors installed in the hotel were furnished by the Allis-Chalmers Company, Milwaukee, Wis., and the Ward Leonard Electric Company, Bronxville, N. Y., supplied the controlling apparatus for the motors. Marshall & Fox were the architects and L. L. Summers & Company their consulting electrical and mechanical engineers. The hotel is owned by the Drake Hotel Company and Tracy C. Drake and John B. Drake are president and vice-president respectively.

George Westinghouse.

E. J. Edwards, a journalist who is known for the authority and accuracy with which he writes, presented a study of Goerge Westinghouse in the New York *Times* of Sunday, August 7, 1910. Among other interesting things, Mr. Edwards said:

George Westinghouse is surely to take rank with a little group, not more than seven in all, whose inventive genius, whose stupendous gifts of imagination, have made the material development of the United States in 100 years possible. This thought was voiced in a statement made to the present writer by the late Abram S. Hewitt, himself a masterly judge of the relations of great events, each to the other, and all to the material prosperity of this country.

Mr. Hewitt said: "The discoveries and inventions of Sir Henry Bessemer and the apparatus invented by George Westinghouse made possible the opening up of the Greater West to exploitation and development. We could not have furnished the railroad facilities adequate for the agricultural commerce possible in the Greater West had it not been for the steel rail and the air-brake."

The ablest of the students of our material development, from the beginning until at last we have become a true world power, are inclined to the opinion that Eli Whitney, Robert Fulton, Dr. Morse, George Westinghouse, Thomas A. Edison, Cyrus McCormack and Prof Bell, together, represent the wonderful intellectual power which, having mastered science, each in his particular field, led it captive, so that it served the welfare of the world.

Mr. Westinghouse, undoubtedly, is in the public mind chiefly associated with the invention of the air-brake. And this is possibly due to the fact that something of romance and much of surprise were associated with the first announcement that a young man, only twety-one years of age, just out of the Union Army, had brought to the authorities of the Pennsylvania Railroad at Pittsburg an apparatus which, he said, would enable a locomotive engineer completely to control a train.

The invention was regarded as completely original, as was the apparatus of Morse of utilizing the electric current so that it could instantaneously convey intelligible messages for a distance of many miles. And it is probably correct to say that, in the first inspiration and in the working out of the nascent idea, as well as in the methods that were adopted to bring the apparatus into general use, Mr. Westinghouse revealed the full power of his genius.

But, although the public will probably always associate Mr. Westinghouse especially with the apparatus by which railway trains are controlled, it is probable that from the intellectual point of view and also the temperamental, his achievements in the field of electricity are to be regarded as the greatest of all his works. For, in addition to the conception of apparatus for the utilizing of a certain form of electric energy, which had always been regarded as of relatively small commercial value, Mr. Westinghouse was compelled to spend many years in overcoming both commercial and scientific objections to the utilization of the electric energy of alternating currents of high voltage through the static transformer, so that this energy becomes equivalent energy at a lower voltage.

He, working in co-operation with others, discovered how it would be possible to make an inert mass of metal capable of transforming alternating currents of 100,000 volts into currents of any required lower voltage, doing this with the loss of only a trifle of the energy. To have done this was to discover one of the greatest agents of modern civilization, provided the apparatus could be devised by which the discovery could be utilized.

This is what Mr. Westinghouse, in association with some others, did; and it is one of the answers those who know of his achievements and know the man make to the accusation that he lacks high ability as a man of finance, that he was able to promote—using that word in its best meaning—this discovery, so that at last it represents probably an actual capitalization, directly and indirectly, of nearly $100,000,000.

The air-brake and the Westinghouse apparatus for utilizing the alternating current of electric energy represent together a capitalization of nearly $130,000,000, if we include in this estimate the various subsidiary and allied industries which sprang from the original invention.

Of course, it is impossible to trace accurately the increase of material wealth to its sources, but there can be no doubt that Mr. Westinghouse's achievements, first through his inventive genius and afterward through his ability to secure capital, establish plants, and develop business, must have been of benefit to the American people by an amount estimated in money value as many hundred millions of dollars.

In intellect and temperament Mr. Westinghouse may be easily classed with what is called the romantic type as distinguished from the phlegmatic. Were he of the latter type he unquestionably would have been numbered with the great intellects like Faraday, Mayer, and Helmholtz, as well as Joseph Henry, who were exclusively occupied with the business of research, the fascinating attempt to penetrate the mysteries of Nature, compelling her to yield up some of her secrets, and having done this, then to venture still further excursions in this mystic field.

To the romantic type belong in our day men like Kelvin, Edison, Bell; and, in the past, Davy, Liebig, Fulton, Eli Whitney, and James Watt. The phlegmatic temperament produces the cold-blooded, absolutely abstract intellectual processes in which imagination has no part. The romantic type is especially distinguished for enthusiasm and for imaging and imaginative power, such as in more primitive days, and in the ages before science was greatly utilized, produced the great works of imaginative literature, of art, and, to some extent, of music.

The Tech Wireless Club of Massachusetts Institute of Technology and that of the University of Pennsylvania have formed an intercollegiate association, and Cornell and Princeton will probably join it next year. These clubs have already done much to prevent the interference of amateurs with government messages.

THE BRUSSELS EXHIBITION.

BY HENRI MARCHAND.

The ELECTRICAL REVIEW AND WESTERN ELECTRICIAN recently gave a preliminary description of the Brussels Exhibition. The following is a supplementary account of some of the principal electrical and mechanical exhibits.

Four hundred British makers and manufacturers are exhibiting in the British section, partly in the International Industrial Hall and partly in the Machinery Hall. Among these may be noted the following: Kelvin and James White, Ltd. (Lord Kelvin's measuring instruments), Gambrell Brothers (measuring instruments and accessories), Nalder Brothers and Thompson, Ltd. (measuring and recording instruments), Cambridge Scientific Instrument Company (physical and electrical measuring instruments), Robt. W. Paul (measuring and testing instruments), Morgan Crucible Company (Morganite and Battersea carbon products), Reflector Syndicate (electrodeposited glass and metallic mirrors), Muirhead and Company (automatic telegraph apparatus), John Dugdill and Company (electric-light fittings), Faraday and Sons (electric-light fittings), Brady and Martin (X-ray apparatus and accessories), Synchronome Company (Synchonome system of electric clocks), R. Waygood and Company (electric lifts), Marryat and Place (electric lifts), C. A. Parsons and Company (steam turbines and electrical generators), Welmann, Seaver and Head (fuses, resistance grids, brakes).

A great variety of machine tools, spinning and ropemaking machines, printing machines are also interesting in connection with the electrical drive. Builders of steam engines and gas engines are furthermore exhibiting special generators. Mavor and Coulson are exhibiting their "pick-quick" bar coal-cutters with electric drive.

Generally speaking, the apparatus exhibited were selected with the greatest care and are conspicuously of the best construction; numerous of them are of new design.

The following instruments and engines are worthy of special mention:

Irwin Hot-Wire Oscillograph.—This outfit is assembled in such a way that it requires only a minimum amount of space, and is so wired that no special manipulative skill is required to put it at once into service. All switches and terminals are clearly marked. The maker has designed this instrument so that its use offers no more difficulty than that required to connect up a wattmeter. With this arrangement the electrical engineer is enabled readily to investigate any abnormal phenomena which may occur either on his supply

FIG 1.—MOVING PART OF UNIPIVOT GALVANOMETER.

system or in the behavior of his machine or other apparatus.

Unipivot Galvanometers and Measuring Instruments.—These instruments are based on the single-pivot construction, the invention of which marked a new era in the application of the moving-coil principle, and has brought into commercial use these convenient and

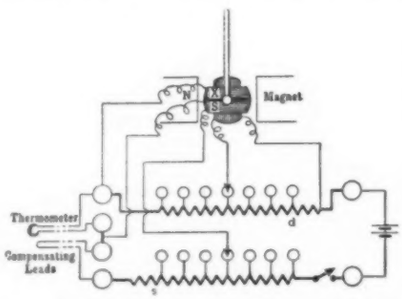


FIG. 2.—HARRIS RESISTANCE-THERMOMETER INDICATOR.

portable pivoted instruments for tests which previously required apparatus with delicate suspensions. Fig. 1 shows the principle of construction. The coil is wound on a metal ring of channel section, carried by a vertical axis with a fine pivot at the lower end. The pivot is at the exact center of the coil and works in a jeweled cup at the center of a spherical iron core, about which the coil may turn in any direction without touching. The whole moving system is so balanced that its center of gravity is at the pivot, and the unipivot instruments therefore require no leveling. The connection of the coil is made by a flexible silver ligament at the bottom and by a coaxial spiral, forming the control spring at the top. This spring carries no part of the weight of the coil, but tends to maintain the latter in its normal position when the instrument is subjected to tilting or vibration. Various forms of unipivot instruments and several testing sets with such instruments are exhibited. Among the latter is a direct-reading unipivot universal testing set measuring from 0.0001 to 600 volts in nine ranges, 0.01 to 600 megohms in seven ranges, 0.00001 to ten ohms in four ranges, 0.000001 to 120 amperes in eleven ranges for power to seventy-two kilowatts. This set is simple, practical, self-contained and portable. Its uses are direct-current measurements, localizing faults or discontinuities in underground cables, and general testing.

Harris Resistance-Thermometer Indicator.—This instrument is direct-reading without manipulation and obviates the objections which have hitherto hindered the use of resistance thermometry in workshop practice. It is constructed on the principle of the differential galvanometer with an electrical control. One of the differential windings is shunted (see Fig. 2) with a platinum thermometer, the other winding being shunted by a resistance which is made variable so as to equal the resistance of the thermometer at certain fixed temperatures. The control coil of the ohmmeter system is also shunted with a resistance, the value of which is determined by the degree of sensitiveness required, and may be made variable with the resistance shunting the winding. These shunted windings are connected in series and the circuit is completed through a battery and a switch. The instrument, as designed for a full range of temperatures, measures from minus 200 degrees to 1,200 degress centigrade. It is arranged to give a deflection of ninety degrees of arc for a temperature variation of 200 degrees centigrade. Using a platinum thermometer, a slider, mounted on the instrument, enables the range covered by the deflections to be set at minus 200 degrees centigrade to zero, zero to 200 centigrade, and so forth, by changing the shunt of the differential winding, and simultaneously varying the shunt

of the control winding, thus compensating for the decreased change of the resistance of the thermometer at higher temperatures. The scale is calibrated in degrees centigrade to Professor Callendar's formula.

Whipple Temperature Indicator.—This is a small portable temperature indicator to be used in connection with electrical resistance thermometers. To take a reading with it, a handle which controls a sliding contact is turned until a pointer indicates that the balance point is obtained, the temperature at the thermometer being then read directly off the scale. One of the chief features is the arrangement of the scale in a spiral fashion on a drum, thus permitting readings to be obtained to one degree even up to 2,200 degrees Fahrenheit or 1,200 degrees centigrade. This instrument is shown in Fig. 3.

Cambridge Temperature Thread Recorder.—This instrument, shown in Fig. 4, consists of a suspended-coil millivoltmeter in which the pointer is automatically depressed by clockwork every minute, thus forcing an inked thread on to a chart and giving a permanent record of the temperature. The drum carrying the chart rotates once in twenty-five hours. Pyrometers and thermometers in connection with electric indicators or recorders are extensively used in European metallurgical works, chemical works, gas works, steam stations, breweries, etc.

Féry Radiation Pyrometer.—Two forms are exhibited, the common tube radiation pyrometer and the spiral radiation pyrometer. The latter is shown in Fig. 5. The principle of these instruments is well known. The radiation pyrometer is of great utility in connection with casting furnaces, rolling mills, steel furnaces, blast furnaces, annealing furnaces, hardening furnaces and for all operations where it is not permitted or desirable to have the temperature-measuring instruments in contact with the body subjected to the measurement.

Broca Galvanometer.—This galvanometer (Fig. 6) is of the moving vertical-magnet type first suggested by Prof. Andrew Gray, then modified by Professor Broca, and further developed by Doctor Harker of the National Physical Laboratory, Teddington, England. The magnet consists of two vertical steel wires, magnetized so that the two ends are of like polarity, with a consequent pole at the middle. The whole system is suspended by a fine quartz fiber, supplying to a small degree the controlling force, the rest being given principally by the magnet at the back of the instrument. The ebonite coil-boxes are covered by a thin metallic shield. The leveling screws are fitted with ebonite insulating toes. A light aluminum damping vane is attached to the lower end of the suspended system, beneath

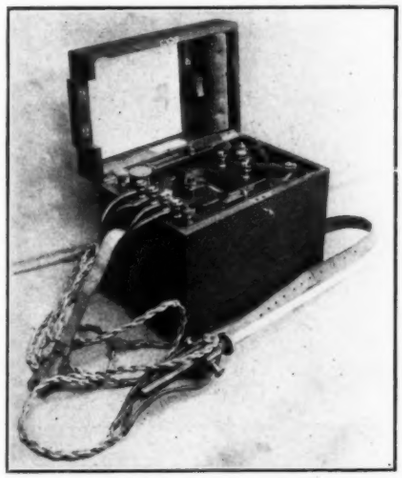


FIG. 3.—WHIPPLE TEMPERATURE INDICATOR.

the mirror, stationary damping plates being fitted on each side of it.

Duddell's Thermal Instrument.—This system includes a thermogalvanometer, and a new thermo-ammeter. The thermogalvanometer can be used for the measurement of extremely small alter-

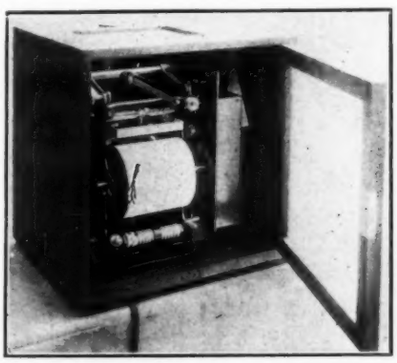


FIG. 4.—CAMBRIDGE THREAD RECORDER.

nating or pulsating currents to a high degree of accuracy, and was successfully utilized in the Duddell, Marconi, and Bellini and Tosi researches in telephony and radiotelegraphy. Both instruments consist principally of a resistance which is heated by the current to be measured, the heat thus generated heating a thermal junction connected directly to a loop placed in the field of a permanent magnet. The advantage of this system is its freedom from self-induction or capacity. (See Fig. 8.)

Einthoven String Galvanometer.—This galvanometer has been developed by Professor Einthoven, but the detailed designs for the instrument exhibited were made by W. Duddell. It is essentially of the moving-coil type, the coil being reduced to a single string or fine wire stretched in a very narrow air-gap between the poles of a powerful electromagnet. Deflections of the string are observed by means of a microscope passing through a hole bored in the pole-pieces or by projection on a special screen, making use of screen, arc lamp and projection lantern. The instrument is extremely sensitive, very deadbeat, has a very short period and is practically without self-induction or capacity. Professor Einthoven used it to advantage in physiological investigations. Used in conjunction with a photographic recording apparatus, it was applied in radiotelegraphic work by Professor Poulsen.

Wilson Electrometer and Electroscope.—C. T. R. Wilson has designed an universal portable electrometer (Fig. 7) for the measurement of low and high potentials, the essential feature being that the gold leaf hangs within an inner case which is maintained at a suitable potential by means of a quartz Leyden jar. This apparatus, although specially designed for measurements in atmospheric electricity, may be used for all purposes to which a quadrant electromoter is usually applied. The micro-electroscope is essentially a gold-leaf electroscope and it is peculiarly adapted for experiments on ionization and radioactivity.

Duddell Oscillographs.—The oil bath contains two vibrators and a fixed mirror, so that two curves and a zero line are obtained simultaneously. Three distinct types are made—high-frequency oscillograph, permanent-magnet oscillograph, and projection oscillograph. The second type can be supplied with insulation for 50,000 volts.

Standards.—This class of apparatus is principally illustrated by a Weston normal cell, a Duddell magnetic standard, a Campbell standard inductance, etc. The principal object of the Duddell magnetic standard is the calibration of ballistic galvanometers under conditions identical with those under-

which they are used, thus avoiding the application of corrections for damping, etc. It includes two fixed coils (through which a known direct current flows), and two moving coils which are connected in series with the galvanometer. The coils can be rotated through an angle of 180 degrees by releasing a spring, thus causing them to cut the magnetic flux generated by the fixed coils.

FIG. 5.—FERY PYROMETER.

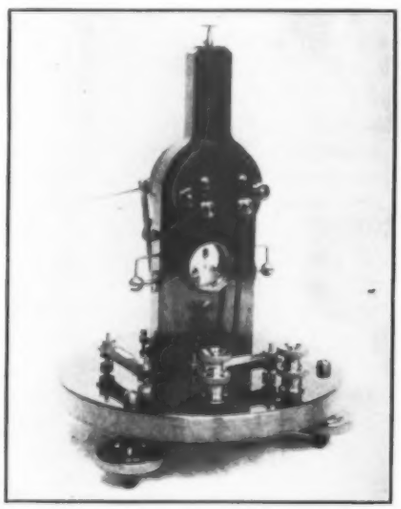


FIG. 6.—BROCA GALVANOMETER.

Muirhead Siphon Recorder.—The essential feature of this recorder is the new suspension piece. The siphon cradle is attached, on the left, to a fiber which connects it to a fixed part of the bridge, and, on the right, to a fiber loop which after passing over a circular attachment to the cradle is secured to a spring by which the suspension is kept taut. The receiving coil itself is supported by two single fibers, the controlling force being furnished by the cradle suspension. The vibration electromagnet is fixed on the left extremity of the bridge and above the latter. A speed of twenty-five words a minute is commonly obtained with the Muirhead recorder on the longest submarine cables of the Anglo-American Company.

Pick-Quick Coal-Cutter.—This cutter is one of the best known of coal-cutting machines. It has a very wide range of adaptability and it has practically been worked out at the coal face, being the outcome of many years' experience. It is designed for undercutting coal on the longwall system of mining. The bar, on being swung round in a horizontal plane, cuts itself into the face. The machine will cut either backwards or forwards, and the bar can be used at either side. The machine exhibited is of the small size, its total height being fifteen and one-quarter inches. It is fitted with a cutter bar three feet six inches long. Larger sizes of machines are fitted with cutter bars respectively four feet six inches and six feet long.

Parsons Dynamo and Alternator.—A continuous-current dynamo of 1,000 kilowatts at 550 volts, 1,800 revolutions per minute, is exhibited by C. A. Parsons. The armature shows the Parsons patented method of winding with partially imbedded conductors. A magnet system, including the Parsons patented compensating winding, enabling satisfactory commutation to be obtained with carbon brushes up to 50 per cent overload at voltages from 440 to 600, is also exhibited. The most interesting part of this exhibition is, however, a working model illustrating Parsons alternator compounding, designed for keeping the voltage of alternators steady with heavily fluctuating loads. This system is based on the fact that while not being able to produce an unidirectional field, alternating current is capable of causing a considerable weakening of such a field, and compounding is thus realized by winding coils on dispersion armatures of the magnet, in the exciter, and connecting these windings to neutral conductors from the alternator, the outgoing terminals being connected to earth.

Pure Fused Silica Ware.—"Vitreosil," or vitreous silica ware, is interesting to electricians as being a product of the electric furnace. Resistance furnaces are used for its manufacture. Arc furnaces are not suitable because they introduce impurities in the ware.

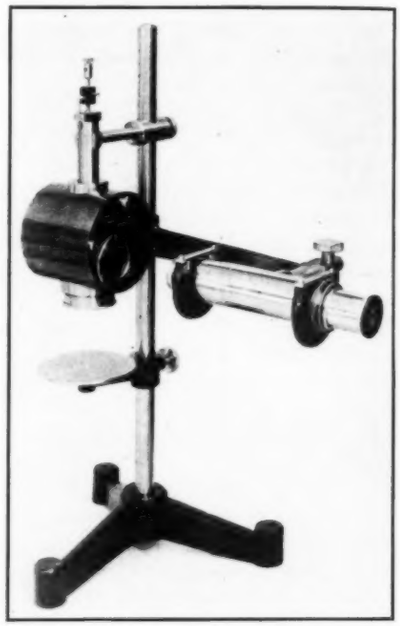


FIG. 7.—WILSON ELECTROSCOPE.

Great difficulties were encountered in the achievement of the process of fusing and molding silica. The makers are now able to fuse some sixty pounds at once and they manufacture crucibles, basins, muffles, tubes, coils, coolers, pipes, tanks, insulators, and many other articles for laboratory and industrial purposes. Silver-sand is the raw material they use.

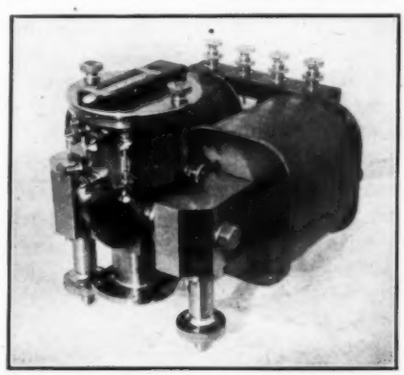


FIG. 8.—DUDDELL THERMO-GALVANOMETER.

Electrochemistry.—Exhibits illustrating the electrochemical industry are contributed only by the United Alkali Company and consist merely of specimens of the company's products.

THE WORCESTER POLYTECHNIC INSTITUTE.

BY NORMAN MARSHALL.

This school was founded in 1865 and has consistently followed the central idea of its founders, to equip its students to "do things."

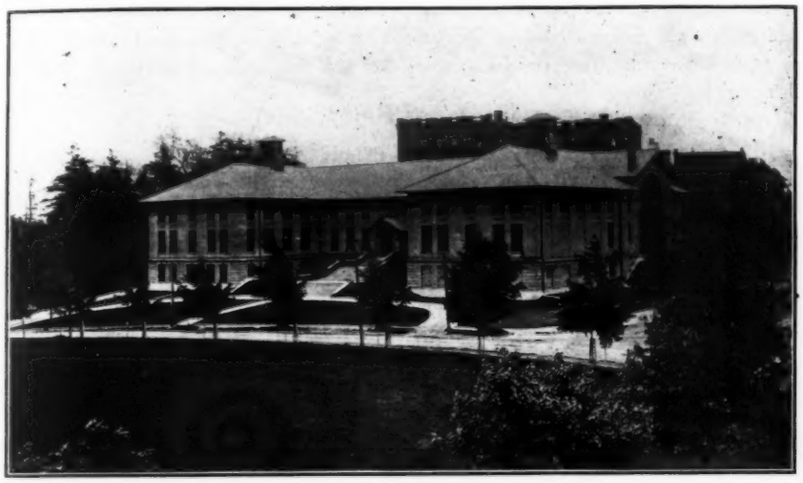


FIG. 1.—ELECTRICAL ENGINEERING BUILDING.

The Electrical Engineering Department was established in 1896 and the present Electrical Engineering Building was completed in 1907. This building is the largest building devoted exclusively to electrical engineering to be found in any college in the world, costing about $250,000 for building and equipments.

FIG. 2.—VIEW OF GENERAL LABORATORY.

The general arrangement of the building is that of large general laboratories separated from two wings by a fire wall which extends to the roof. These two wings are each about sixty feet square and three stories in height. They contain lecture rooms, recitation and design rooms, library, offices and special laboratories.

The General Laboratory.—This room is 200 feet in length by fifty-five feet in width and is served by a ten-ton electric traveling crane. With its galleries, this room has a floor area of 19,400 square feet and a volume of about 400,000 cubic feet. With the large windows and central court between the wings all the rooms are well lighted.

The artificial lighting is arranged with a view, not only to thorough illumination but also as an educational demonstration of the various lighting systems and types of electric lights.

The experimental equipment of the general laboratory comprises over fifty generators and motors, including all the important types. There are forty transformers of various types and sizes, over 250 instruments, two storage batteries and a collection of special machinery and apparatus. This equipment is arranged with special standardized terminals and circuits so that any combination of circuit, instruments and apparatus is readily secured for experimental purposes. It will be impossible to mention more than a few of the more important features.

The power for the laboratory is supplied at 2,200 volts by underground cables from the Power Laboratory of the institute, where there are three service units.

The generating units consist of direct-connected two-phase, sixty-cycle generators and engines of 75, 175, and 350 horsepower, respectively, controlled by a very complete switchboard of eleven panels, which permits a separation of the service and experimental loads.

In addition to the large amount of electrical equipment of the Electrical Engineering Building, aggregating 1,500 kilowatts, which is controlled from the general laboratory switchboard, there is supplied a service from the laboratory to the large number of lights and motors used in the other buildings on the campus. The circuits of this system, because of their application, illustrate most of the methods of power transmission and distribution.

A 300-horsepower current generator, which may also be used as a rotary converter or motor, with connections to the circuits of the Worcester Consolidated Street Railway Company, affords a substation equipment in the laboratory.

Ranging from this machine down to the smallest instruments, the equipment of generators, motors, transformers, lamps, accessory apparatus and instruments includes examples of all the principal commercial types and a number which have been especially designed for experimental purposes.

The Electrical Railway Equipment.—This is situated at one end of the laboratory. Two tracks connecting with the tracks of the local street railway,

and in that way, with the suburban and interurban railways of New England, enter the laboratory on space covered by the traveling crane. One of these tracks is over an inspection pit. The second track enters to a testing plant, where a car or electric locomotive under test rests and runs on wheels carried by axles which transmit the power from the car to special electric absorption dynamometers and flywheels. The pedestals carrying these axles may be moved to accomodate cars of any truck or wheel base, and the flywheels are so arranged that their weight may be changed to correctly imitate the linear inertia of cars of any weight within wide limits. The car under test is anchored to the end post. This coupling may include a traction dynamometer.

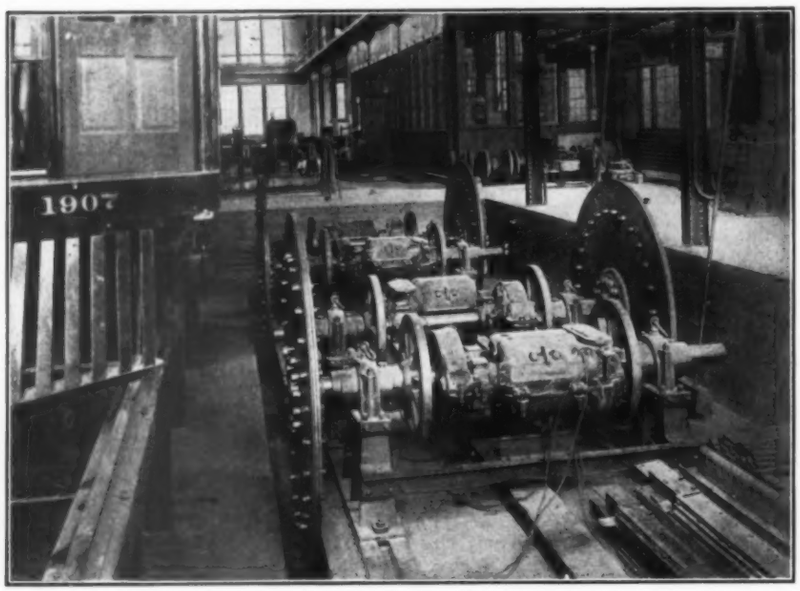


FIG. 3.—ELECTRIC RAILWAY TESTING STAND.

A double-truck four-motor interurban car, designed particularly for experimental and testing work forms an important portion of the equipment. This car is fully equipped with special apparatus, and is available for experimental and testing work either on the test stand in the laboratory or for practical testing on the lines of any electric railway.

The set of recording instruments, which is an important feature of the equipment, was designed and built at the Institute by members of the department who have had wide experience in railway testing. In connection with the Institute car, they are arranging to give an autographic record of the electrical conditions (of rail bonding, trolley insulation, feeder drop, etc.) of any line over which the cars may be operated.

The Lecture Hall.—This has a seating capacity for 300 persons and is thoroughly equipped for the projection of lantern slides and experimental demonstration. A carefully designed switchboard controls the supply circuits and any machinery in the general laboratory which may be used in connection with demonstration lectures. High-potential currents up to 500,000 volts can be brought into the room.

The Department Library.—The library consists of a carefully selected collection of about 2,500 volumes. Additions make this a rapidly growing library, which is already one of the best special libraries on electrical engineering subjects in the United States.

Some Special Features.—The Institute was one of the first colleges to provide instruction in electrical engineering design. Work of this character is offered in courses extending from the middle of the Junior year to the close of the Graduate year, under the direction of men experienced in practical engineering design. The Standards and Research Laboratory is thoroughly equipped with standards of measurement by American and European makers accompanied by certificates from the Reichsanstalt, Kelvin Laboratory and National Bureau of Standards. This equipment is very valuable and includes a complete line of Kelvin balances, Wolff and other potentiometers and bridges, Rosa curve tracer oscillographs, Rowland dynamometer, Weston standard instruments and shunts, chronographs, vacuum pumps, etc.

The High-Potentials Laboratory is provided with high-voltage transformers ranging up to 500,000 volts and of ample capacity for the thorough study of the problems presented in long-distance power transmission.

Personal Organization.—Far more important however than the physical equipment of the Electrical Laboratories of the Worcester Polytechnic Institute is the personal ability and enthusiasm of the teaching staff, which includes many men successful in commercial as well as theoretical electrical engineering, headed by Prof. H. B. Smith, an electrical engineer of international reputation, especially in high-tension problems, who is frequently called in consultation by large electrical concerns.

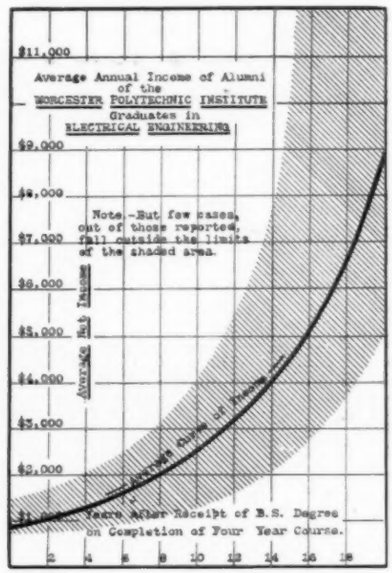


FIG. 4.—INCOME OF ALUMNI.

The final test of any machine or institution is its product. That the product of the Worcester Polytechnic Institute is appreciated is shown by the fact that a large electrical manufacturing concern recently offered employment to the entire graduating class of the Institute in electrical engineering.

The curve, Fig. 4, shows graphically the practical quality of engineers produced by the Electrical Department.

A DEVICE FOR MEASURING THE TORQUE OF ELECTRICAL INSTRUMENTS.

BY P. G. AGNEW.

The instrument here described was designed specifically for the determination of the torque of electrical measuring instruments, but is generally applicable to the measurement of small horizontal forces.

It operates on the pendulum principle as is shown in Fig. 1, the essential feature being the use of a spherical scale S, turned from a brass casting, to a radius of curvature of one meter. The bob is supported from an adjustable arm and so arranged that the point of support P is at the center of curvature of the spherical scale. A silk fiber is used as a suspension, and is wound on the friction pin A for convenience in adjusting its length. The fiber passes though a V-shaped notch in the end of the brass strip P, which is capable of a small horizontal adjustment to aid in the initial centering.

The whole is mounted on an ordinary laboratory clamp stand, the tripod being fitted with leveling screws. The clamp C allows the scale and bob to be lowered as a unit, for convenience in applying to an instrument.

The graduations of the scale consist of 153 concentric circles, the distance between successive circles being approximately one millimeter. The diameter of the scale is thirty centimeters. Since the horizontal deflecting force varies as the tangent of the angle of displacement, it is necessary, in order that the instrument should be direct reading, that the circles should be so spaced as to read off the tangents of the angles of deflection directly. If the length of the pendulum is one meter, and the distances between successive circles were exactly one millimeter, we should have for small angles

$\theta = \tan\theta = .001, .002, .003$, etc.

To make the scale read exact tangents for the larger angles the following method was adopted.

The hollow spherical bowl, after having been turned by the usual method, was kept in the lathe without being taken from the face plate, the screw carrying the tool post set perpendicular to the axis, and the center then carefully located by the graving tool. The tool was then moved out from the center, by successive steps, the following distances measured in millimeters:

1000 sin (tan 0.001)
1000 sin (tan 0.002)
* * * * * * *
1000 sin (tan 0.153)

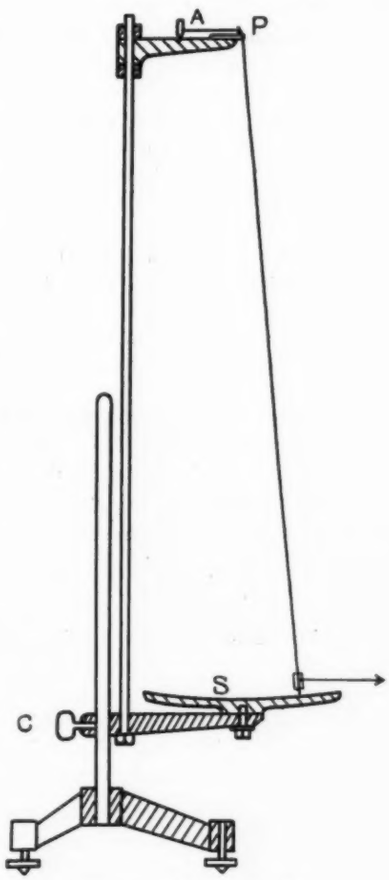


FIG. 1. TORQUE METER.

and the 153 circles engraved at these settings. A little consideration will show that this procedure makes the scale read tangents of angles directly,

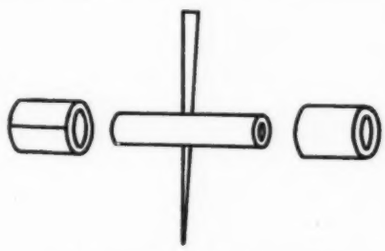


FIG. 2. DETAILS OF BOB.

since the radius is 1,000 millimeters. The scale is practically uniform.

The bob consists of a small hollow brass cylinder with a fine sewing needle passed through it perpendicular to the axis, as shown in Fig. 2. The silk fiber by which the horizontal force to be measured is transmitted to the bob is attached to the needle and passes out along the axis of the hollow cylinder. The point of attachment is made at the center of mass of the bob, which for convenience is marked by a file scratch. The mass of the bob alone is adjusted to 0.5 gram, but in order to change the range, concentric cylinders, each cut in halves, are made to fit snugly over the inner cylinder, as is indicated in the figure. These extra cylinders make the total mass 1, 2, 5, 10 and 20 grams respectively, giving a range of 40 to 1 for full-scale deflection. A radial saw cut in each half-cylinder allows these extra weights to be slipped in place without disconnecting either of the silk fibers.

For the measurement of forces we have the relation:

Horizontal force in grams = weight $\times$ 0.001 $\times$ reading in divisions.

For the measurement of torque, the horizontal thread is fastened to the pointer or disk of the instrument whose torque is to be determined, at a known distance from the axis. We then have

Torque = arm $\times$ weight $\times$ 0.001 $\times$ reading in divisions.

The level may be easily checked by lowering the bob until it just clears the scale, and swinging it over different parts of the scale. If it does not touch at any point the level is correct.

Measurements may easily be made to 0.2 per cent, or if care be used in the adjustments and the deflection kept near full scale, to 0.1 per cent.

Tantalum Lamps of Improved Efficiency.

Tantalum lamps having an efficiency of 1.7 watts per candlepower have been manufactured and put on the market by the Siemens Brothers Dynamo Works, of London, England. They have tubular bulbs of a diameter of one and one-half inches and are particularly designed for reflectors in window lighting and other places where a tubular lamp is desired. The overall length of each lamp is five and one-quarter inches. The lamps are rated at twenty-five candlepower and are suitable for series or parallel connection with 100 to 130 volts at the lamp terminals. It is claimed that these lamps will give as long a life and give as good efficiency on alternating currents as on direct currents.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

CENTRAL-STATION ECONOMY.

BY P. E. MATTESON.

A systematic analysis of the possibilities of a more economical maintenance of central stations depending upon steam for power should begin with the coal, for in coal there is probably a more continual loss, occasioned by the methods or lack of methods in its purchase, than any other thing connected with a central station.

In order to appreciate the possibilities of loss in coal it is necessary to consider the characteristics of coal which so admirably adapt it for heating purposes. The geological and geographical aspects of coal are too well known to receive any attention here, but the chemical construction upon which depends the heating value of our fuel seems to have been entirely neglected.

Coal as it is mined contains fixed carbon, volatile hydrocarbons, moisture, and ash. The heating power depends upon the amount of fixed carbon and of hydrocarbons present, the freedom of burning increases with the amount of volatile hydrocarbons, ash is undesirable since it replaces just so much carbon, and moisture retards the heating power until driven off.

The unit for the measurement of heat is called British thermal unit and corresponds to the amount of heat necessary to raise the temperature of one pound of water, one degree Fahrenheit. One pound of pure carbon can supply about 14,600 such units, and one pound of the volatile hydrocarbons would be somewhat higher in heating power than carbon, on account of a small percentage of hydrogen, which has a heating power of about 62,000 British thermal units per pound in a pure state. On the other hand, the ash has no heating power whatever, and moisture must be driven off at an expenditure of heat. Consequently a coal which is sufficiently rich in fixed carbon and volatile matter to overcome the deleterious effects of moisture and ash, and maintain a heating power about equal to the heating power of pure carbon is a very good coal indeed.

It is quite evident that with all these varying influences present in coal there can be a wide range of values, and that is indeed the case. Out of some 350 samples tested by the government no two were found exactly alike, although many samples came from the same coal field and even from different drifts of the same mine. It is also evident that the coal user who buys his coal from an honest dealer or a reputable mine depending upon past performances of both dealer and mine is very likely not to get the grade of coal desired unless he submits samples from each shipment to test.

Nearly all large users of coal, including our Government, have resorted to the test method as the only logical method of buying coal. The results obtained have been very satisfactory, particularly to the Government, and a summary of the results and methods of the Government will easily prove the advantages of a universal adoption of the method of purchase by test.

The Government buys annually about $7,000,000 worth of coal delivered to different points. A separate contract is let covering each point of delivery, specifying both the quantity and quality of coal acceptable, specifying also the price to be paid for coal of the heating value offered by the successful bidder, and establishing a schedule of premiums and deductions for deliveries of coal over or under the specified standard in heating value.

A specific case is plainer. Assume that two contractors bid on a lot of coal. One contractor bids $3.00 per ton for coal to contain 14,000 thermal units per pound, while the other bids $2.80 per ton for coal to contain 12,000 thermal units per pound. While the second bid appears $0.20 lower than the first, it would really be considerably higher, for at $3.00 per ton for 14,000 units coal would be $0.107 per million thermal units, while the $2.80 coal of 12,000 units would be $0.116 for the same amount of heat. The first bidder would get the contract.

Assume further now that the first month's deliveries on this contract average coal of 13,500 units per pound instead of 14,000. The amount paid for coal delivered this month would then be $2.89 per ton. If the next monthly average were coal of 14,300 thermal units the price paid for that coal would be $3.06 per ton, and so on throughout the length of the contract.

To establish a test method of coal purchases is not at all difficult for any average-sized central station. There are few lighting plants not large enough to consume a sufficient amount of fuel to warrant considerable competition among the fuel dealers, and wherever such competition exists the dealers will submit to tests, or any other reasonable means to get the business.

In conclusion, I would suggest that every user of coal submit a sample of the coal he is using to some testing laboratory for analysis; the results of a trial test would be interesting and probably instructive.

Milwaukee Company to Develop Water Power.

John I. Beggs, president of the Milwaukee Light, Heat and Traction Company, of Milwaukee, Wis., is quoted as stating that the company will spend $1,000,000 during the next two or three years in developing the water power of the upper Wolf River for the operation of the interurban system of the Fox River Valley owned by the company.

New Municipal Plant at Buda Pesth.

The city council of Buda Pesth, Hungary, recently decided to erect a municipal electric plant. A prize contest for its design and construction was ordered at the same time.

ICE-MAKING AS AN OFF-PEAK LOAD.

BY JOSEPH B. BAKER.

The art of making a uniform twenty-four-hour load is one of the central-station manager's most valuable assets. In the ordinary lighting plant the large engines and thousands of dollars' worth of expensive machinery are idle all day and are taxed to their utmost only in the evening hour when the "peak" or heavy lighting load is in force. The energetic efforts of solicitors in selling flat-irons, single-phase motors and other pieces of apparatus used largely during the day hours have increased the revenue of twenty-four-hour stations to such an extent that many companies now recognize the practicability of offering reduced rates for power during their light load, or even of expending considerable amounts of capital in order to encourage overtime loads.

The ice-making process has always been considered a desirable load for the station because the power consumed is generally steady for the entire twenty-four hours. A recently adopted process in which a complete make of ice may be produced in less than twenty hours places the ice business in an entirely new light to the central-station manager. In other words, a station may be equipped with an ice-making plant without any disturbance or addition to the peak load, since the ice apparatus may be completely shut down and the ice harvested during the heavy-load period.

In supplying power to an artificial ice-making plant the station can safely figure on a load of about two kilowatts for every ton of capacity of the ice plant, so that a fifty-ton plant would consume one hundred kilowatts for twenty hours, or two thousand kilowatt-hours every night. The added cost to the station would be about three and one-half tons of coal per day, the oil, wages and repairs remaining the same, so that the manager can easily afford to make a concession from the usual rate since the cost per kilowatt-hour will be considerably less than one cent. On the other hand, the returns to the customer from the ice sales should bring a suitable profit, since fifty tons of ice can be turned out every day at a cost for power of only forty kilowatt-hours per ton. With ice valued at $3.00 per ton at the plant and a low rate of manufacturing labor per ton the ice maker could afford to pay from three to five cents per kilowatt-hour, which would be an ample return for the station manager.

A still better proposition would, of course, be the installation and operation of the ice plant by the central station itself. With a short transmission, attendance always at hand, and an absolute control of the load so connected, the ice plant can be run at only such times as are advantageous to the station and with very little cost. The engineer can readily adapt himself to the care of the brine pumps during the twenty hours of ice freezing, and extra men can be called in for three or four hours during the peak load to harvest the ice. The plant can be operated at any time during the year which is convenient for the station, since the ice can be stored with good results for six months without refrigeration. It is fortunate, however, that the heavy ice consumption of summer comes at the light part of the station's yearly load so that less storing is required than would at first sight seem necessary.

The essential point of interest in the new ice process is the rapid production which is made possible by the method of freezing from the center. The apparatus consists of a series of pipes which are lowered into tanks of water. The brine is pumped through the chain of piping until the ice is formed into solid cakes which cling to the pipes. The piping or grid, together with the ice is then raised by means of a hand crane and warm brine is passed through the grid for a few minutes to release the pipes from the ice. A power saw hanging from the crane then cuts the large cakes into market size and the ice is ready for delivery.

Ice from this process is clean in every respect and may be used for drinking purposes. The hole left by the pipes in the center of the cake does not injure the keeping qualities, but may be filled with water and the cake refrozen if the trade requires.

Air bubbles are avoided by a continual circulation of the water, which is caused by small bubbles of air allowed to issue from the bottom of the tank, and all metal parts are tinned, so that the apparatus presents a very pleasing appearance for public approval.

The space required for the ice-making apparatus is comparatively small. A tank sixteen feet wide and nine feet long will produce six cakes fifteen feet wide, nine and one-half feet deep and eleven inches thick. A cutting table sixteen by ten feet will complete the apparatus necessary in the ice room. The pumps and storage tanks can be placed at any convenient point nearby.

The Fuel Supply of the Pacific Coast.

During the ten years between 1899 and 1908 the ratios of mineral-fuel consumption in the Pacific states were as follows: Coal, 41.1 per cent; coke, 1.9 per cent; fuel oil, 57 per cent. Of the coal, 77 per cent was derived from domestic sources, and of this the Washington fields supplied about 85 per cent.

Notwithstanding their large use of fuel oil the Pacific states and territories now use about 4,500,000 tons of coal and about 130,000 tons of coke. It is reasonable to assume that during the next decade the California oil pools will not make the same rate of increase in output that they have made during the last decade and therefore that Alaska's immense store of coal may find profitable demand on the Pacific coast.

The completion of the Panama Canal may enable eastern operators to deliver high-grade coals on the Pacific coast at prices about the same as those that can be offered by operators in Alaska.

Power Development in Seville, Spain.

United States Consul Charles S. Winans writes that it does not seem to be generally known that Seville is becoming a manufacturing city for many classes of goods, the chief drawback to more rapid development being the great expense of motive power, as all the power used is produced by the use of coal or the refuse of olives for generating steam or electricity.

When the irrigating scheme now under discussion becomes a reality, several reservoirs will be built at different levels, using the water of the Guadalquivir River for the purpose. The falls between the reservoirs will be utilized for the production of electricity for light and power purposes.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

Illumination of Buildings at the Oregon Agricultural College.

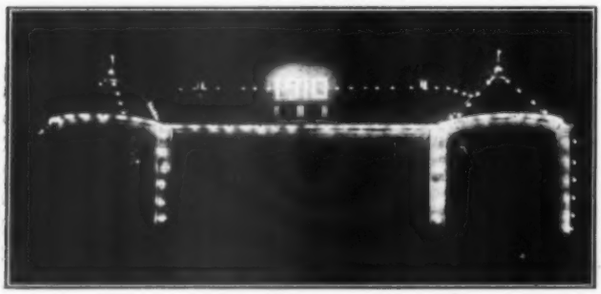
The students of the Oregon Agricultural College organized an electrical show last April, and one of the features of the show was the illumination of the engineering buildings, all the work being done by the students. This show was very successful, and the proceeds went to the support of the journal *Student Engineer*, which is published by the students of the college.

In connection with the commencement festivities which marked the quarter centennial of the foundation of the college, the illumination was repeated. The sign "Electrical Show" was replaced by "1910" as shown in the illustration of Mechanical Hall.

cent of the graduating class are following engineering.

The equipment of the electrical engineering laboratory is very good, comprising twenty-five machines, which range from a three-kilowatt motor-generator set to a 12.5-kilowatt compound direct-current generator. The equipment includes one-, two-and three-phase induction motors; revolving-field alternators; and a good assortment of instruments and meters on a thirty-eight foot switchboard.

There is an adequate number of portable instruments and a set of precision standards. Power is obtained from a long-distance, high-tension transmission line for which there is a special station on the campus.



Mechanical Hall.

Science Hall and Administration Building.

ILLUMINATION OF OREGON AGRICUTURAL COLLEGE BUILDINGS.

The other view shows both the Science Hall and the Administration Building, the latter bearing the greeting to alumni and friends "Welcome."

The electrical engineering department of the College is in charge of Prof. Thos. M. Gardner, who has done a great deal to build up this department. Branches of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers flourish at the college.

The number of electrical engineering students registered during the past year was 118; twenty-one of these were graduated this year, two receiving the degree of Electrical Engineer and nineteen that of Bachelor of Science in Electrical Engineering. Eighty-five per

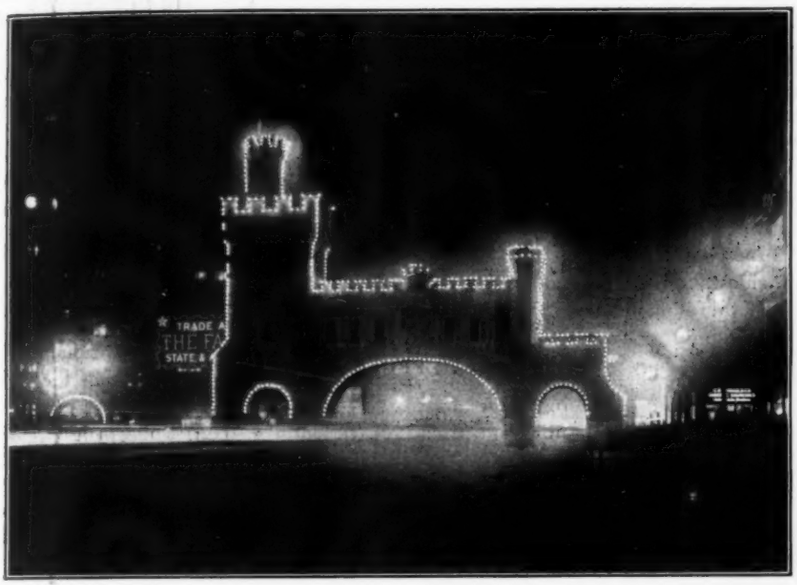
Electric Train Lighting.

The London *Electrical Review*, in commenting on the relatively slow progress of electric lighting in Great Britain, says that it has often pointed out the danger involved by the use of gas for lighting trains, and the horrible sufferings inflicted upon the imprisoned passengers in the event of a collision. Many instances are on record, both in England and on the Continent, of persons being burnt to death through this cause in sight of their friends, who are powerless to rescue them. Yet the British Board of Trade, while expressing preference for electric lighting, which is absolutely safe and at least as economical as gas lighting, has taken no active step towards eliminating this risk. The board waits upon public opinion, which is only aroused by the occurrence of disaster, too late to do more than prevent a recurrence; but surely it might bring pressure to bear upon the railway authorities to hasten the adoption of the illuminant which is free from the dangers of gas.

On the Continent some progress has already been made in this direction; the Austrian Ministry for Railways has been requested to discontinue the use of incandescent gas lighting, and to use electric light exclusively on all passenger cars on order or to be constructed in the future. This request, emanating from the Council of the Austrian State Railways, has been backed by the daily press, which quotes the numerous railway accidents which have occurred within the last eight months, accompanied by gas fires and loss of life therefrom. The government admitted that electric lighting presented economic advantages, and undertook that 110 new cars on order for 1911 should be electrically equipped. It was stated in the discussion that all the Swiss railways and the great French railways had decided to adopt the electric light in the future exclusively. Only last month a serious accident took place at Villepreux, when the train was burnt, and it was reported from Paris that the fire was due to the gas used for lighting.

Additional Views of Special Knights Templar Illumination in Chicago.

In the last issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN there appeared several illustrations of the decorative features of the Knights Templar Conclave which was held in Chicago, August 8 to 13.



KNIGHTS TEMPLAR ENTRANCE ARCH.

Those in charge of affairs spared no expense in creating a decorative scheme that will long be remembered by the thousands of visitors as a most gorgeous spectacle.

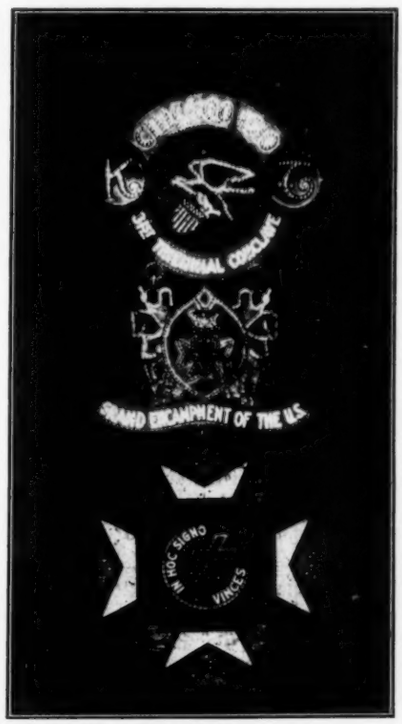
KNIGHTS TEMPLAR GRAND COMMANDERY ARCH.

While the city as a whole entered into the spirit of the occasion and was gaily decorated, the crowning features of the display were the official electrical emblem, the "Templar Way", the entrance arch and the grand commandery arch.

The former was described in detail in our last issue. There is, however, shown herewith a night view of this gorgeous spectacle, also night views of the entrance arch and grand commandery arch. A night view of "Templar Way" was shown last week, also a day view of the emblem.

A Method of Rejuvenating Carbon Filaments.

In the *Elektrotechnische Zeitschrift* there was recently described a method of rejuvenating carbon filaments of incandescent lamps that had burned long enough to blacken the bulb but were not broken. The tip of the bulb is broken off and a piece of glass tubing fused to the end. The bulb is then heated sufficiently to burn off the carbon deposit. A small amount of a suitable hydro-carbon is then introduced into the bulb and the latter is exhausted. After the proper degree of vacuum is attained current is passed through the filament and carbon is thereby deposited on it in a manner similar to that used in the ordinary flashing process. Finally the bulb is resealed. The entire cost of renewal is said to be about five cents per lamp.



THE OFFICIAL CONCLAVE EMBLEM.

Arch Lighting in Cape May.

A system of arch lighting has been adopted and put into effect along the Boardwalk at Cape May, N. J., with great success. The arches are placed at distances of sixty feet for the whole length of the Boardwalk, and between each two there is a column upon which is placed a powerful tungsten electric light to supplement the arches.

Further Lighting Improvements in Philadelphia.

The *Municipal Journal and Engineer* states that the plans of Chief McLaughlin, of Philadelphia's city electrical department, for the better illumination of the city include the erection of electric light standards and pedestrian safety and rest platforms in the center of Broad Street at all street intersections between Spruce and Vine streets, similar to the experimental standard of this order erected at Walnut and Broad streets for public criticism. The plan embraces two such standards, one either side of the car tracks at each street intersection. Apart from providing for the safety of pedestrians, particularly women and children, crossing Broad Street, and the improved illumination of the intersection of Broad and Walnut streets at night, it is the best system for the regulation of traffic that possibly could be devised. With such a fixed center for making turns in any direction at street intersections, drivers of any kind of vehicle were stopped from making dangerous short cuts, and, moreover, in the case of automobiles especially, were obliged to slow up to a reasonable speed.

Mr. McLaughlin said the erection of the new Broad Street lights would not cost the city anything beyond maintenance, as, in the case of the new lights in Market Street, the Philadelphia Electric Company had agreed to erect the standards, as well as the raised concrete platforms, for pedestrians at its own expense. That company, also, he said, would affix to each standard street signs, which at night are brilliantly illuminated, and would also affix such street signs on the light standards, at each street intersection in Market Street free of expense to the city. Each of these street signs, he said, cost about $15, while the cost of each of the new Broad Street electric standards would be about $125.

Chief McLaughlin has submitted three designs that have been approved by Mayor J. E. Reyburn for memorial lamps to be placed in Independence Square. It is proposed to erect fifty-six standards as memorials to the signers of the Declaration of Independence, and to this end the central globe on each standard will be deeply etched with the name of one of the signers that will be plainly visible, either by day or night. An item of $60,000 provides for the standards. Mr. McLaughlin's three designs each comprise ornamental bronzed iron columns carrying three tungsten lamps, the central one in a twelve-inch globe and the two side-arm lamps in nine-inch globes; the height of each standard to the top of the central globe is to be thirteen feet and two inches. One of the designs is to be used for the sidewalk lights in Chestnut, Fifth, Sixth and Walnut streets; another design for two electric light standards on the sidewalk directly facing the entrance to Independence Hall, and the third design for two or more of the standards to be erected in the center of Independence Square.

Ornamental Street Lighting in Atlanta.

In the city of Atlanta, Ga., a strong movement has been started for the ornamental lighting of the main business streets. In particular it is planned to create a "White Way" on Peachtree Street from Ellis to Whitehall streets, and Mitchell Street from Whitehall to the terminal station. Five-lamp tungsten clusters on ornamental iron columns are to be placed on each side of the three streets about seventy feet apart. These will replace the old arc lamps and provide an illumination "that will be effective, but not glaring, that will light all the buildings from top to bottom and will cast over the entire streets a radiance which will be soft, brilliant and without casting a single shadow," says the Atlanta *Constitution*.

It is calculated that the installation of these new lamps will cost about $1.92 per front foot. To raise the funds it has been proposed to assess one-half this cost to the property owner and the other half to the tenant. The proposition has been received quite enthusiastically. The city will be asked to maintain the new lamps in place of the old arc lamps.

Electric-Sign Market in Scotland.

Consul J. N. McCunn of Glasgow, Scotland, in a recent issue of *Daily Consular and Trade Reports*, states at length his reasons why American exporters of electric signs should find a good market for their wares in the great Scotch commercial metropolis, Glasgow. He further states that British towns in general are deficient in the matter of electric-sign advertising.

Where Tungsten Street Lamps Should Have Been Used.

A newspaper dispatch from Haverhill, Mass., states that more than 200 of the gas street lights are out of order as a result of the swarms of moths, bugs and flies which are attracted by the glare of the lamps at night. The police have been reporting them during the siege of warm weather, but one night recently the returns eclipsed all records in point of numbers, more than 200 lights being reported as requiring new mantles and globes. This is due directly to the action of the swarms of bugs which fly through the flames, breaking the mantle, crawling into vents and causing them to smoke and finally the accumulation of dead ones clogging them so as to prevent the lights from burning.

Illuminating Engineering Society Membership Campaign.

The membership committee of the Illuminating Engineering Society has been making a whirlwind campaign for new members, and the initiation fee is being waived in favor of those who join now.

A letter recently sent out by the committee makes the following appeal:

The Illuminating Engineering Society has in a dignified, yet active membership campaign, succeeded in increasing its membership twenty-five per cent. Although the Society is somewhat restricted in its activities—concening itself with illumination only—it is none the less valuable. The very fact of this restriction makes its activities intense and pointed. No other society was sufficiently interested to bring about such legislation as the adoption of the international standard of candlepower. Few other societies are so constituted and organized to conduct a course of lectures such as the Lecture Course to be given at Johns Hopkins University this fall.

The Society is one of proper organization and of proper activities. Its very existence and object should warrant its support by all those allied with, or interested in the lighting industry.

The membership committee is composed of J. Robert Crouse, chairman; W. H. Gartley and Professor H. B. Dates. Application blanks may be secured from the chairman, 1818 East 45th Street, Cleveland, O.

TELEGRAPHY—TELEPHONY, and WIRELESS.

USE OF HOT-WIRE AMMETERS IN THE AERIAL OF WIRELESS TELEGRAPH STATIONS.[1]

BY JOHN S. STONE.

As the hot-wire ammeter is very generally in use in the aerial of wireless telegraph stations, the interpretation of its readings becomes of importance.

The current in the aerial of most wireless telegraph stations consists of a periodic succession of damped trains of oscillations. These oscillations have in general two periods T_1 and T_2, which are termed the wave or oscillation periods. The time interval between recurrences of the trains of oscillations, T_0, is termed the spark, wave, or oscillation train period. This time interval is in general long enough to permit the oscillations of each damped train to practically die out before the next succeeding train starts.

Each oscillation train is given by the expression

$$i_2 = A_2\left\{\epsilon^{-\alpha_1 t}\sin(\beta_1 t+\phi) - \epsilon^{-\alpha_2 t}\sin(\beta_2 t+\phi)\right\}$$

where $\beta_1 = \frac{2\pi}{T_1}$ and $\beta_2 = \frac{2\pi}{T_2}$

The amplitude of the oscillations is

$$A_2\left\{\epsilon^{-2\alpha_1 t} + \epsilon^{-2\alpha_2 t} - 2\epsilon^{-(\alpha_1+\alpha_2)t}\cos(\beta_1-\beta_2)t\right\}^{\frac{1}{2}}$$

These expressions are true in by far the greater number of wireless telegraph stations, since in these in most instances the oscillations are developed in a primary oscillating circuit either inductively or conductively coupled with the aerial in such a manner as to give rise to currents in the latter having two periods.

When the oscillation train period T_0 is sufficiently great to permit each oscillation train to become practically extinct before the following train is generated, the expression for the mean of the square of the current in the aerial or for the hot-wire ammeter deflection is

$$\frac{A^2_2}{T_0}\left[\frac{1}{4}\left\{\frac{1}{\alpha_1}+\frac{1}{\alpha_2}-\frac{1}{\rho_1}\cos(2\phi+\delta_1)-\frac{1}{\rho_2}\cos(2\phi+\delta_2)\right\}+\frac{1}{\rho_3}\cos\delta_3-\frac{1}{\rho}\cos(2\phi+\delta_1)\right]$$

where

$$\rho_1^2=\alpha_1^2+\beta_1^2,\ \rho_2^2=\alpha_2^2+\beta_2^2,\ \rho_3^2=\alpha_3^2+\beta_3^2,\ \rho^2=\alpha^2+\beta^2$$

$$\alpha=\alpha_1+\alpha_2,\ \alpha_3=\alpha_1-\alpha_2,\ \beta=\beta_1+\beta_2,\ \beta_3=\beta_1-\beta_2$$

$$\delta_1=\tan^{-1}\frac{\beta_1}{\alpha_1},\ \delta_2=\tan^{-1}\frac{\beta_2}{\alpha_2},\ \delta=\tan^{-1}\frac{\beta}{\alpha}$$

and $\delta_3=\tan^{-1}\frac{\beta_3}{\alpha_3}$

The square of the readings of a hot-wire ammeter in the aerial will, if multiplied by one-half the inductance of the coils in the aerial, give the mean kinetic energy in the coils of the aerial, and if multipled by the resistance of the aerial it will give the energy dissipated in the aerial, but since in general there are currents of two frequencies developed in the aerial and since[2] the "resistance equivalent of radiation" of the aerial is a function of the period of the current producing the radiation, the amount of radiation from the aerial cannot in general be determined from the reading of a hot-wire ammeter in the aerial.

When the coupling of the transmitter is sufficiently loose to insure the development of oscillations of but a single periodicity in the aerial the expression for the oscillation trains is

$$i_2 = A_2(\epsilon^{-\alpha_1 t}-\epsilon^{-\alpha_2 t})\sin\left(\frac{\beta}{2}t+\phi\right)$$

and the reading of the hot-wire ammeter in the aerial multiplied by the resistance equivalent of radiation of the aerial for the periodicity of the oscillations developed will give the rate of radiation of energy. It is necessary, however, to know the periodicity with considerable precision as the resistance equivalent of radiation is proportional to the square of the periodicity.

The expression for the oscillation trains in the primary is

$$i_1 = A_1(\epsilon^{-\alpha_1 t}\sin\beta_1 t + m_1\epsilon^{-\alpha_2 t}\sin\beta_2 t)$$

and for its amplitude

$$A_1(\epsilon^{-2\alpha_1 t} + m_1^2\epsilon^{-2\alpha_2 t} + 2m_1\epsilon^{-\alpha t}\cos\beta_3 t)$$

where

$$A_1=\frac{\rho_1^2\rho_2^2 Q_0}{\alpha_1\rho_2+\alpha_2\rho_1 m_1}$$

Q_0 being the initial charge of the condenser. The square of the reading of an ammeter or the mean-square of the current in this circuit is proportional to

$$\frac{A_1}{T_0}\left[\frac{1}{4}\left\{\frac{1}{\alpha_1}+\frac{m_1^2}{\alpha_2}-\frac{\alpha_1}{\rho_1^2}-\frac{m_1^2\alpha_2}{\rho_2^2}\right\}+\frac{m_1\alpha}{\rho_3^2}-\frac{m_1\alpha}{\rho_2^2}\right]$$

The hot-wire ammeter reading gives no information as to the maximum amplitude of the oscillation trains while this is the important value for the range of the station.

It is to be remembered that the root-mean-square value of alternating currents as measured by hot-wire ammeters is of importance only because in light and power circuits this is the effective value of the current, i. e., the direct current which would produce the same effect as the alternating current so far as the rate of doing work is concerned, but these considerations do not as a rule hold in the case of the current in the aerial of wireless telegraph stations. The reading of a hot-wire ammeter in the aerial of a wireless telegraph station therefore cannot in general be of service except in facilitating the adjustment of the aerial for a maximum of current.

1 Abstract of a paper presented at a meeting of the Society of Wireless Telegraph Engineers held in Boston, Mass., on June 4, 1910.

2 The resistance equivalent of radiation is a concept due to the author, see "The Theory of Wireless Telegraphy," by J. S. Stone, Volume III Transactions International Electrical Congress, St. Louis, 1904. It is a quantity, the product of which with the square of the current in an oscillator gives the rate of radiation of energy by the oscillator at any moment.

The History of the Telephone.

Litigation Over the Telephone—I.

BY HERBERT N. CASSON.

For seventeen months no one disputed Bell's claim to be the original inventor of the telephone. All the honor, such as it was, had been given to him freely, and no one came forward to say that it was not rightfully his. No one, so far as we know, had any strong desire to do so. No one conceived that the telephone would ever be any more than a whimsical oddity of science. It was so new—so unexpected, that from Lord Kelvin down to the messenger-boys in the telegraph offices, it was an incomprehensible surprise.

But after Bell had explained his invention in public lectures before more than twenty thousand people, after it had been on exhibition for months at the Philadelphia Centennial, after several hundred articles on it had appeared in newspapers and scientific magazines, and after actual sales of telephones had been made in various parts of the country, there began to appear such a succession of claimants and infringers that the forgetful public came to believe that the telephone, like most inventions, had been the product of many minds.

Just as Morse, who was the sole inventor of the telegraph in 1837, was confronted by sixty-two rivals in 1838, so Bell, who had been the sole inventor in 1876, found himself two years later almost mobbed by the "Tichborne claimants" of the telephone. The inventors who had been his competitors in the attempt to produce a musical telegraph, persuaded themselves that they had unconsciously done as much as he. Any possessor of a telegraphic patent, who had used the common phrase, "talking wire," had a chance to build up a plausible story of prior invention. And others came forward with claims so vague and elusive that Bell would scarcely have been more surprised if the heirs of Goethe had demanded a share of the telephone royalties on the ground that Faust had spoken of "making a bridge through the moving air."

This babel of inventors and pretenders amazed Bell and disconcerted his backers. But it was no more than might have been expected. Here was a patent—"the most valuable single patent ever issued"—and yet the invention itself was so simple that it could be duplicated easily by any smart boy or any ordinary mechanic. The making of a telephone was like the trick of Columbus in standing an egg on end. Nothing was easier to those who knew how. And so it happened that as the crude little model of Bell's original telephone lay in the Patent Office, open and unprotected except by a few phrases that clever lawyers might evade, there sprang up inevitably around it the most costly and persistent Patent War that any country has ever known, continuing for eleven years and comprising six hundred law-suits.

The first attack upon the young telephone business was made by the Western Union Telegraph Company. It came charging full tilt upon Bell, driving three inventors abreast—Edison, Gray and Dolbear. It expected an easy victory; in fact, the disparity between the two opponents was so evident, that there seemed little chance of a contest of any kind. "The Western Union will swallow up the telephone people," said public opinion, "just as it has already swallowed up all improvements in telegraphy."

At that time, it should be remembered, the Western Union was the only corporation that was national in its extent. It was the most powerful electrical company in the world, and as Bell wrote to his parents—"Probably the largest corporation that ever existed." It had behind it not only forty millions of capital, but the prestige and favor of leading financiers. Also, it met the telephone pioneers at every point because it, too, was a wire company. It owned rights of way along roads and on house-tops. It had a monopoly of hotels and railroad offices. No matter in what direction the Bell Company turned, the live wire of the Western Union lay across its path.

From the first, the Western Union relied more upon its strength than upon the merits of its case. Its chief electrical expert, Frank L. Pope, had made a six-months' examination of the Bell patents. He had bought every book in the United States and Europe that was likely to have any reference to the transmission of speech, and employed a professor who knew eight languages to translate them. He and his men ransacked libraries and Patent Offices. They rummaged and sleuthed and interviewed; and found nothing of any value. In his final report to the Western Union, Pope announced that there was no way to make a telephone except Bell's way, and advised the purchase of the Bell patents. "I am entirely unable to discover any apparatus or method anticipating the invention of Bell as a whole," he said; "and I conclude that his patent is valid." But the officials of the great corporation refused to take this report seriously. They threw it aside and employed Edison, Gray and Dolbear to devise a telephone that could be put into competition with Bell's.

As we have seen in the previous chapter, there now came a period of violent competition which is remembered as the Dark Ages of the telephone business. The Western Union bought out several of the Bell exchanges and opened up a lively war on the others. As befitting its size, it claimed everything. It introduced Gray as the original inventor of the telephone, and ordered its lawyers to at once take action against the Bell Company for infringement of the Gray patent. This high-handed action, it hoped, would most quickly bring the little Bell group into a humble and submissive frame of mind. Every morning the Western Union looked to see the white flag flying over the Bell headquarters. But no white flag appeared. On the contrary, the news came that the Bell Company had secured two eminent lawyers and were ready to give battle.

The case began in the autumn of

1878, and lasted for a year. Then it came to a sudden and most unexpected ending. The lawyer-in-chief of the Western Union was George Gifford, who was perhaps the ablest patent attorney of his day. He was versed in patent lore from Alpha to Omega; and as the trial proceeded, he became convinced that the Bell patent was valid. He notified the Western Union that its case could not be proven, and that "Bell was the original inventor of the telephone." The best policy, he suggested, was to withdraw its claims and make a settlement. This wise advise was accepted, and the next day the white flag was hauled up, not by the little group of Bell fighters, who were huddled together in a tiny, two-room office, but by the mighty Western Union itself, which had been so arrogant when the encounter began.

A committee of three from each side was appointed, and after months of disputation, a treaty of peace was drawn up and signed. By the terms of this treaty the Western Union agreed—

(1) To admit that Bell was the original inventor.

(2) To admit that his patents were valid.

(3) To retire from the telephone business.

The Bell Company, in return for this surrender, agreed—

(1) To buy the Western Union telephone system.

(2) To pay the Western Union a royalty of twenty per cent on all new contracts.

(3) To keep out of the telegraph business.

This agreement, which was to remain in force for seventeen years, was a master-stroke of diplomacy on the part of the Bell Company. It was the Magna Charta of the telephone. It transformed a giant competitor into a friend. It added to the Bell system 56,000 telephones in 55 cities, at a cost of $270,000. And it swung the valient little company up to such a pinnacle of prosperity that its stock went skyrocketing until it touched $1,000 a share.

The Western Union had lost its case for several very simple reasons. It had tried to operate a telephone system on telegraphic lines, a plan that has invariably been unsuccessful. It had a low idea of the possibilities of the telephone business; and its already busy agents had little time or knowledge or enthusiasm to give to the new enterprise. With all its power, it found itself out-fought by this compact body of picked men, who were young, zealous, well-handled and protected by a most invulnerable patent.

The Bell Telephone now took its place with the telegraph, the railroad, the steamboat, the harvester and the other necessities of a civilized country. Its pioneer days were over. There was no more ridicule and incredulity. Everyone knew that the Bell people had whipped the Western Union, and hastened to join in the grand Te Deum of applause. Within five months from the signing of the agreement, there had to be a reorganization; and the American Bell Telephone Company was created, with $10,000,000 capital. In the following year, 1881, twelve hundred new towns and cities were marked on the telephone map and the first dividends were paid—$178,500. And in 1882 there came such a telephone boom that the Bell System was multiplied by two, with more than a million dollars of gross earnings.

At this point all of the earliest pioneers of the telephone, except Vail, pass out of its history. Thomas Sanders sold his stock for somewhat less than a million dollars, and presently lost most of it in a Colorado gold mine. His mother, who had been so good a friend to Bell, had her fortune doubled. Gardiner G. Hubbard withdrew from business life, and as it was impossible for a man of his ardent temperament to be idle, he plunged into the National Geographic Society. He was a Colonel Sellers whose dream of millions had come true; and when he died in 1897 he was rich both in money and in the affection of his friends. Charles Williams, in whose workshop the first telephones were made, sold his factory to the Bell Company in 1881 for more money than he had ever expected to possess. Thomas A. Watson resigned at the same time, finding himself no longer a wage-worker but a millionaire. Several years later he established a ship-building plant near Boston, which grew until it employed 4,000 workmen and had built half a dozen war-ships for the United States navy.

As for Bell, the first cause of the telephone business, he did what a true scientific Bohemian might have been expected to do—he gave all his stock to his bride on their marriage day and resumed his work as an instructor of deaf mutes. Few kings, if any, had ever given so rich a wedding present; and certainly no one in any country ever obtained and tossed aside an immense fortune as incidentally as did Bell. When the Bell Company offered him a salary of $10,000 a year to remain its chief inventor, he refused the offer cheerfully on the ground that he could not "invent to order." In 1880 the French Government gave him the Volta prize of 50,000 francs and the Cross of the Legion of Honor. He has had many honors since then, and many interests. He has been for thirty years one of the most brilliant and picturesque personalities in American public life. But none of his later achievements can in any degree compare with what he did in a cellar in Salem, at twenty-eight years of age.

They had all become rich—these first friends of the telephone, but not fabulously so. There was not at that time, nor has there been since, anyone who became a multi-millionaire by the sale of telephone service. If the Bell Company had sold its stock at the highest price reached in 1880, it would have received not more than four millions of dollars—a huge enough sum, but not too much pay for the invention of the telephone and the building up of a new industry. It was not as much as the value of the eggs laid during the last five months by the hens of Kansas.

Now, as may be imagined, when the news of the Western Union agreement became known, the story of the telephone became a fairy tale of success. Theodore N. Vail was given a banquet by his old-time friends in the Washington postal service, and toasted as "the Monte Cristo of the Telephone." It was said that the actual cost of the Bell plant was only one twenty-fifth of its capital, and that every four cents of investment had thus become a dollar. Even Jay Gould, carried beyond his usual caution by these stories, ran up to New Haven and bought its telephone company, only to find out later that its earnings were less than its expenses.

Much to the bewilderment of the Bell Company, it soon learned that the troubles of wealth are as numerous as those of poverty. It was beset by a

throng of promoters and stock-jobbers, who fell upon it and upon the public like a swarm of seventeen-year locusts. In three years 125 competing companies were started, in open defiance of the Bell patents. The main object of these companies was not, like that of the Western Union, to do a legitimate telephone business, but to sell stock to the public. The face value of their stock was $225,000,000, although few of them ever sent a message. One company of unusual impertinence, without money or patents, had capitalized its audacity at $15,000,000.

How to hold the business that had been established—that was now the problem. Not one of the Bell partners had been mere stock-jobbers. At one time they had even taken a pledge not to sell any of their stock to outsiders. They had financed their company in a most honest and simple way; and they were desperately opposed to the financial banditti, whose purpose was to transform the telephone business into a cheat and a gamble. At first, having held their own against the Western Union, they expected to make short work of the stock jobbers. But it was a vain hope. These bogus companies, they found, did not fight in the open, as the Western Union had. All manner of injurious rumors were presently set afloat concerning the Bell patent. Other inventors, some honest men and some shameless pretenders, were brought forward with strangely concocted tales of prior invention. The Granger movement was at that time a strong political factor in the Middle West, and its blind fear of patents and "monopolies" was turned aggressively against the Bell Company. A few senators and legitimate capitalists were lifted up as the figure-heads of the crusade. And a loud hue-and-cry was raised in the newspapers against "high rates and monopoly" to distract the minds of the people from the real issue of legitimate business versus stock-company bubbles.

ELISHA GRAY.

The most plausible and persistent of all the various inventors who snatched at Bell's laurels, was Elisha Gray. He paid no more attention to the adverse decisions of the courts than to the blowing of the wind among the trees. Again and again he came forward with new weapons and new methods of attack. After each defeat, he became more bitter and irreconcilable; and until his death in 1901 never renounced his claim to be the original inventor of the telephone.

The reason for this persistence is very evident. Gray was a professional inventor—a highly competent man who had begun his career as a blacksmith's apprentice, and risen to be a professor of Oberlin. In 1874 he and Bell were running a neck-and-neck race to see who could first invent a musical telegraph; when—presto—Bell suddenly turned aside, because of his acoustical knowledge, and invented the telephone, while Gray kept straight ahead. Like all others who were in quest of a better telegraph instrument, Gray had glimmerings of the possibility of sending speech by wire, and by one of the strangest of coincidences, he had filed a caveat on the subject on the *same day* that Bell had filed the application for a patent. Bell had arrived first. As the Record Book shows, the fifth entry on that day was "A. G. Bell, $15;" and the thirty-ninth entry was "E. Gray, $10."

There is a vast difference between a caveat and an application. A caveat is a declaration that the writer has *not* invented a thing, but believes that he is about to do so; while an application is a declaration that the writer has *already perfected* the invention. But Gray could never forget that he had seemed to be, for a time, so close to the golden prize; and seven years after the Western Union agreement, he reappeared with claims that had grown larger and more definite.

When all the evidence in the various Gray law-suits is sifted out, there appear to have been three distinctly different Grays. First, Gray the scoffer, who examined Bell's telephone at the Centennial and said it was "nothing but the old lover's telegraph. It is impossible to make a practical speaking telephone on the principle shown by Professor Bell. . . . The currents are too feeble." Second, Gray, the convert, who wrote frankly to Bell in 1877—"I do not claim the credit of inventing it." And third, Gray the claimant, who endeavored to prove in 1886 that he was the original inventor.

It is now clearly seen that the telephone owes nothing to Gray. There are no Gray telephones in use in any country. Even Gray himself, as he admitted in court, failed when he tried to make a telephone on the lines laid down in his caveat. The final word on the whole matter was recently spoken by George C. Maynard, who established the telephone business in the city of Washington. "Mr. Gray was an intimate and valued friend of mine," said Mr. Maynard, "but it is no disrespect to his memory to say that on some points involved in the telephone matter, he was mistaken. No subject was ever so thoroughly investigated as the invention of the speaking telephone. No patent has ever been submitted to such determined assault from every direction as Bell's; and no inventor has ever been more completely vindicated. Bell was the first inventor and Gray was not."

AMOS E. DOLBEAR.

After Gray, the weightiest challenger who came against Bell was Professor Amos E. Dolbear, of Tufts College. He, like Gray, had written a letter of applause to Bell in 1877. "I congratulate you, Sir," he said, "upon your very great invention, and I hope to see it supplant all forms of existing telegraphs, and that you will be successful in obtaining the wealth and honor which is your due." But several years later Dolbear came to view with an opposition telephone. It was not an imitation of Bell's, he insisted, but an improvement upon an electrical device made by a German named Philip Reis in 1861.

Thus there appeared upon the scene the so-called "Reis telephone," which was not a telephone at all, in any practical sense, but which served well enough for nine years or more as a weapon to use against the Bell Patents. Poor Philip Reis, himself, the son of a baker in Frankfort, Germany, had hoped to make a telephone, but he had failed. His machine was operated by a "make-and-break" current, and so could not carry the infinitely delicate vibrations made by the human voice. It could transmit the *pitch* of a sound, but not the *quality*. At its best, it

could carry a tune, but never at any time a spoken sentence. Reis, in his later years, realized that his machine could never be used for the transmission of conversation; and in a letter to a friend he tells of a code of signals that he has invented.

Bell had once, during his three years of experimenting, made a Reis machine, although at that time he had not seen one. But he soon threw it aside, as of no practical value. As a teacher of acoustics, Bell knew that the one indispensable requirement of a telephone is that it shall transmit the *whole* of a sound, and not merely the pitch of it. Such scientists as Lord Kelvin, Joseph Henry and Edison had seen the little Reis instrument years before Bell invented the telephone; but they regarded it as a mere musical toy. It was "not in any sense a speaking telephone," said Lord Kelvin. And Edison, when trying to put the Reis machine in the most favorable light, admitted humorously that when he used a Reis transmitter he generally "knew what was coming, and knowing what was coming, even a Reis transmitter, pure and simple, reproduces sounds which seem almost like that which was being transmitted; but when the man at the other end did not know what was coming, it was very seldom that any word was recognized."

In the course of the Dolbear lawsuit, a Reis machine was brought into court, and created much amusement. It was able to squeak, but not to speak. Experts and professors wrestled with it in vain. It refused to transmit one intelligible sentence. "It *can* speak, but it *won't*" explained one of Dolbear's lawyers.

It is now generally known that although a Reis machine, when out of order, would transmit a word or two in an imperfect way, it was built on wrong lines. It was no more a telephone than a wagon is a sleigh, even though it is possible to chain the wheels and make them slide for a foot or two. "A century of Reis would never have produced a speaking telephone by mere improvement of construction," said Judge Lowell, in rendering his famous decision. "It was left for Bell to discover that the failure was due not to workmanship but to the *principle* which was adopted as the basis of what had to be done. . . . Bell discovered a new art—that of transmitting speech by electricity, and his claim is not as broad as his invention. . . . To follow Reis is to fail, but to follow Bell is to succeed."

[EDITOR'S NOTE.—This is the seventh part of a series of telephone articles by Mr. Casson on the History of the Telephone. Chapter II of "Litigation over the Telephone" will appear in our next issue, and will conclude the series.]

Wireless Messages Transmitted Through the Earth.

The transmission of wireless messages through the crust of the earth is the latest development of radiotelegraphy. The exchange of wireless signals through the earth has been made by two German physicists, who, with the permission of the royal mining authorities, have made a series of trials of radiotelegraphy at the Diennenburg potash mine and have succeeded in exchanging long-distance signals with simple instruments.

According to the latest announcement Doctors Loewe and Leimbach, the German savants who accomplished this wireless feat, are satisfied that it would be possible to penetrate to even greater depths through the crust of the earth.

Compulsory Installation of Telephones in Ohio Mines.

It is believed, says *Telephony*, that the next session of the Ohio General Assembly will enact a law compelling all operators of coal mines to equip their mines with complete telephone systems. This is in force in the state of Illinois, where it has proven a great help to the men in time of danger. Several of the members of the Ohio General Assembly are drafting bills which will be introduced at the opening sessions.

The New Commonwealth Edison Booklet.

The Commonwealth Edison Company has published a booklet giving a short account of the company's physical properties and tangible assets. This booklet is not only handsomely printed and well illustrated, but it tells a remarkable story within the compass of a very few pages. The addenda giving some pertinent facts and figures concerning the company is well arranged and serves to add greatly to the interest of the more extended study. One of the significant statements in this book is as follows:

"The plants, equipment and physical properties created out of such large sums of money must of necessity be of a very substantial character. Indeed at the time of the consolidation (Chicago Edison and Commonwealth Electric) two and one-half years ago, an exhaustive examination and appraisal of the property showed real estate, plants and other assets amounting to $52,495,749.18, or more than $1,500,000 in excess of the par value of all the bonds and stock of the company outstanding at the time. Since then many large additions have been made to the company's plants and the conduit system has been widely extended."

While drawing on a population of about 2,250,000 the company has a steady list of over 125,000 direct customers. This list is growing every day. Its employees number over 3,000, and by a recent arrangement for buying stock in the company on time payments as an investment for savings, many of them have now become stockholders and have a very vital interest in the company's future growth and progress.

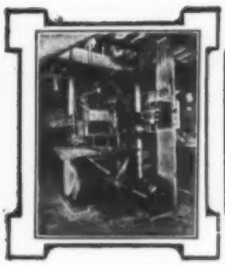
That the company is to be a very great factor in the city of Chicago's future is most aptly and convincingly shown by the statement of the fact that towards the close of June, 1910, the city controller received a check for $325,313.00 from the company as the city's share in the earnings of the company for the year ending May 31, 1910. Accompanying the check went the statement that the income from the sale of current for the year was $10,824,470, of which the city received three per cent, and from the rental of conduit space $5,792, of which the city received ten per cent.

Telephone Merger Stopped.

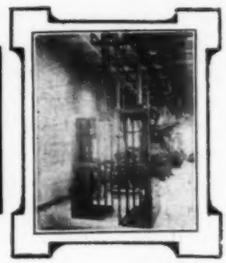
An injunction has been granted in the state of Illinois, preventing the taking over of the Vandalia Telephone Company of Vandalia, Ill., by the Central Union Telephone and the American Telephone and Telegraph Companies. The Kinloch Long-Distance Telephone Company which has petitioned for the writ alleges that the proposed combination will form a monoply in violation of the law.

Russian Wireless Stations.

Wireless telegraph stations are being erected at Petropavlosk and Nicolaevsk. The equipment was supplied from St. Petersburg.



Industrial Power



ELECTRICAL POWER IN MACHINE SHOPS.

BY C. H. PALMER.

The electrical powering of machine shops in the most economical manner is a problem which may now be said to have been thoroughly mastered by electrical engineers. The essential factors which have to be considerd in the powering of any plant are dependent upon the economic production of the output, the nature of the products handled and the possibility of future development. It may be positively stated as a well established fact resulting from comparative tests on steam and electrically driven plants that in the former only about sixty-six per cent of the power generated is delivered to the machines actually doing work, in other words, fully one-third of all the power produced in the mechanically-driven equipment under full load, is not available and may be said to be lost; it is in fact absorbed during its transmission from the engine to the point of application. This loss is practically constant, regardless of the number of machines in operation; actual tests have shown that the average load factor is about fifty per cent in most steam power plants; whilst in the electrically equipped plants the efficiency varies slightly, according to the load, and is as high as eighty-five per cent at half or three-quarters load. Electrical equipments may now be considered standard and the benefits are so generally recognized that a great many engineers advise their adoption.

The positive result of an electrical equipment is a reduction of the unit cost; it has been much discussed as to decreased cost of operation and decreased cost of equipment, points which are true in the main, but which do not do justice to it. The capital used may be larger and the operating cost may be more, on the other hand more work is turned out in the same time, so that when the unit cost is worked out, it is found to be much reduced.

Considerable flexibility should always be allowed for in the power-house units and in the designs of the equipments; thus a selection of three small units instead of two large ones may appear to be an extravagant expenditure, when first suggested, but after a few years of natural development, it is usually found to be more satisfactory for an even distribution of load and for a sufficient emergency capacity. Machine tools, it need scarcely be stated, are designed to withstand given strains and stresses in connection with shafts, bearings and so on, and it is uneconomical to try to make a tool do less work than it is constructed for, as it is uneconomical to make it do more work than it can safely stand. The difference between the electric drive and the ordinary drive is that with the latter the machines are connected to their source of power in such a way that when they come to an overload point they refuse to take the power, causing the belts to slip, the excess power being used up in friction; while with the direct-connected motor drive, the machine is not given this alternative and it is in this respect that the engineering precision required by the motor drive means its greatest source of power saving, by holding each machine at its most efficient load. Engineers necessarily differ as to the details of the electrical system most suitable for machine shops; broadly two systems may be mentioned, quite distinct from each other: the alternating-current and the direct-curent systems; these two may also be combined; thus the alternating currents may be used as the main units with the direct current as an auxiliary system, or the direct current for main units and the alternating for auxiliary.

Probably the balance of opinion in Great Britain is in favor of the alternating-current system, with facilities for conversion to direct current, as it has been found to be both economical and reliable. For constant-speed running the induction motor is very suitable and extremely economical; whilst some machines requiring adjustable speed are best operated by direct-current motors, as it would otherwise be necessary with alternating-current motors to provide complicated mechanical speed-changing devices. On a large system the generators and motors are simple and reliable and the wiring is much smaller; but with buildings distributed over a large area and transmission over long distances, the alternating-current system is preferred, as it economizes energy from the switchboard to the machines themselves. The advantages claimed for electrical driving are cleanliness, convenience of placing machines without reference to power supply, facility of motor control and automatic operation; to a considerable extent the elimination of belts and loose pulleys, more light, less noise, increased safety from accidents to workpeople; but the essential advantage is the reduction of the unit cost.

The alternating system has the advantage of reduced loss of energy between the switchboard and the machines requiring the energy, when the distances over which current must be transmitted are considerable. Current can be generated at high voltages and can be transmitted throughout an alternating-current distributing system with a considerable saving in copper, as well as a reduced loss of energy in transmission; but a limit is placed upon the transmission voltage of such a system, as auxiliary apparatus is necessary in the way of transformers to bring the voltage of the system down to a practical operating voltage. It follows that a point may be reached when a saving from reduced copper and energy lost in transmission is offset by an additional outlay for apparatus.

In the case of a plant having all its departments closely centered, compactly arranged and having an equip-

ment consisting of variable-speed machinery, the direct-current system is undoubtedly the proper solution, with individual motors wherever possible; but for a plant which covers a large area and has an equipment demanding large amounts of current, of which only a small portion is used for variable-speed machinery and which is of sufficient size to require separate units for the lighting service, alternating current is strongly insisted on by most European engineers. No very hard and fast rule can be laid down as to which system would be most economical, as conditions are often very complicated, requiring most minute investigation of the installation and a thorough knowledge of the power demands and in addition some knowledge of future expansion. In some conditions therefore it may be confidently stated that the alternating-current system is the most economical and suitable; whilst in other cases in which the character of the power service is more or less varied a careful study of the conditions is imperative before a decision or choice can be made.

There are two types of motors available for the alternating-current system, the induction motor and the synchronous type. The latter is not self-starting, and with the exception of some cases its use for machine tool driving may be said to be limited. It is, however, distinctly desirable in connection with induction motors for steadying the line and improving the power-factor in cases where heavy shafts have to be run for some considerable length of time.

The induction motor is self-starting and tends to run at a constant speed; this type of motor may be adapted to variable-speed service, although primarily available for constant speed. In those installations using alternating-current motors, principally on constant-speed machines, the induction motor, in connection with a mechanical speed-changing device, generally proves very successful for variable-speed demands. The constant speed characteristics of the induction motor make this type especially suitable for machine-shop application. When the load is put on a motor its speed falls until the induced electromotive force in the secondary is sufficient to develop the torque required for the load.

There are three types of motors based on the direct-current system the characteristics of which may be said to cover very completely the requirements of machine-shop tool driving; namely the compound-wound, the series and the shunt-wound varieties. The first of these is applicable where small variations of speed are needed coupled with a large starting torque and when set for certain conditions this type of motor operates at a constant speed. The series motor has a variable speed with great starting torque and can be controlled throughout its whole range of speed. It is however, very uneconomical, as the control is obtained by resistance in its circuit, requiring an expensive controller on account of the heavy currents handled. The speed varies inversely with the load, so that at light loads the speed attained makes it dangerous to the construction of the armature. This type of motor is very suitable for elevators, hoists or cranes. The shunt type may be described as a constant-speed motor, as when it is set to run at a given speed it will not vary much under a varying load up to its capacity. It is possible, however, to make the motor vary in speed in various ways. By varying the current in the armature, by varying the strength of the field and by varying the voltage applied to the armature terminals, a variety of speeds may be obtained. All engineers will recognize that these characteristics make the shunt motor the most suitable of any type of direct-current motors for the purposes of machine-tool driving. By means of these three methods of control either singly or in combination with each other, this type of motor can be made to fulfil the requirements of both variable and constant-speed machines.

Cases occur in the electric powering of machine shops where it is possible to obtain current by purchase from a central power company delivering alternating current; a combination is then possible forming an alternating-current direct-current system, which has several points in its favor, especially in the case of works placed on a straggling site of large area. When power is thus obtained the voltage has to be reduced to the required value by means of transformers at the distributing board of the plant and the low-voltage alternating current can then be used for all power requirements except for driving variable-speed motors and auxiliary apparatus. For machine shops there is this objection to the arrangement that they are reduced to practical idleness in case of a breakdown at the source of supply. When works have their own generating equipment, a system not subject to such eventualities, as well as an economical layout is assured; alternating current can be used for all constant speed and lighting, while motor-generator sets or a rotary converter can be provided to supplement the system and to supply the direct current for variable-speed motors and auxiliary apparatus.

It has been found expedient in machine shops to provide an individual motor drive for drill-presses, radial drills and other machines of the class, which are usually provided with change-of-speed accessories; consequently a constant-speed motor is suitable. Direct-connected motors are also suitable to drive punches, shears and bending rolls; this type does not require variable speed, it follows that an alternating-current or direct-current constant-speed motor is very suitable. Motors for actuating traveling cranes have become very general. The saving in power and other advantages of a carefully thought-out electric-drive installation for machine shops is now fully appreciated by all who have carefully studied the subject.

Railless Traction.

At the recent congress, in Dublin, Ireland, of the Tramways and Light Railways Associtaion, Harry England, general manager of the Yorkshire Tramways Company, Ltd., Wakefield, England, presented a paper on "Railless Traction," in which he gave an account of the three trackless-trolley systems now in successful use, both commercially and from an engineering standpoint, on the continent of Europe.

The first described was the Filovia system, which is operated in Italy over a total route of over sixty miles. In this system the patent Cantano trolley is used, which comprises an ordinary trolley pole and base, and a head consisting of a four-wheeled truck, connected to the pole by a ball and socket joint. This allows the head to move easily and to adapt itself to any irregularities in the overhead line. The overhead work is similar to the overhead work for ordinary rail traction, with the difference, of course, that

there are both positive and negative wires. This construction appears to answer admirably, and the trolley shows no disposition to leave the wires at high speeds, or when the vehicle has to move laterally in order to pass other vehicles traveling in the same direction.

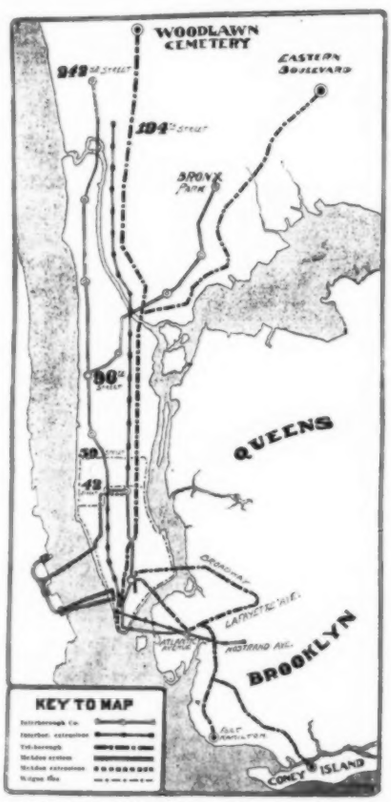
In the Mercédès-Stoll system, as installed in Vienna, motors of twenty horsepower each are fitted in the hubs of the rear driving wheels, so that the motors form an integral part of the driving wheels themselves, thus doing away with the necessity for any mechanical transmission. The cable is carried through the interior of the axle, and the armature of the motor is fixed keyed to the axle itself, and so acts as the nave of the wheel. The trolley consists of a frame or carriage fitted with four wheels, which runs on the tops of the wires, the current-collecting device being attached to the car by means of flexible cables. A pendulum weight is attached to the center of the trolley carriage to keep the latter balanced and the wheels well pressed down on the wires. The conducting cable is wound round a small drum mounted on the chassis, and about twelve yards of spare cable are carried, which can be played out to allow the car to run on the whole width of the road. Four wires are used in Vienna. In other places where only two wires (positive and negative) are erected, the drivers of passing cars interchange the trolleys by means of detachable cable contact boxes, which operation, it was asserted, does not usually take more than a few seconds.

In the Max Schiemann system, installed at Mulhausen, the trolley is similar to that used on the English tramways, with a pole from fourteen and one-half feet to sixteen feet in length. It is fitted with two sliding contacts, and the car can deviate for distances of ten feet on either side of the wires. The overhead work is similar in all respects to ordinary street-railway practice, except that four wires are used.

It was estimated that a trackless-trolley system could be fully equipped, provided current were purchased from a supply authority, at about $15,000 per mile of route, though much would depend upon local conditions. With overhead line and cables at $7,500 per mile, five motor cars at $3,000 each, five trailer cars at $1,250 each, land and depot, $4,000, and spare parts, tools, etc., $4,750, four miles of railless traction would cost $60,000, as against an expenditure of $200,000 for a street railway of a similar length. The author stated that the cost of working a railless traction system in Great Britain has been estimated at 12.328 cents per car-mile, as against 12.988 cents in the case of an ordinary trolley street-railway system.

New Subways Proposed for New York.

A plan for a subway calling for the expenditure of $100,000,000 has been offered to the city of New York by the Interborough Rapid Transit Company of that city. This is the sixth subway offer which the Public Service Commission now has under consideration. The six propositions involve an expenditure of $590,000,000. Proposals which have been made up to date are as follows:



PROPOSED SUBWAYS FOR NEW YORK CITY.

Company.	Cost.
Farrell-Hopper	$130,000,000
Tri-borough	125,000,000
Interborough extensions	100,000,000
Wilgus freight subway	100,000,000
Continuous Transit Company	80,000,000
Inter-Terminal belt (Wilgus)	55,000,000

The projected routes as well as those now in existence may be seen from the accompanying map.

Although all of the companies, with the exception of the Continuous Transit Company, propose that the city appropriate the necessary $510,000,000 for construction, the city has only $60,000,000 available for this purpose.

Arnold Report on Pittsburg Traction.

Bion J. Arnold, of Chicago, consulting engineer for Mayor William A. Magee in the study of the Pittsburg traction problem, has made several suggestions for the improvement of the street car accommodations of Pittsburg, in a report of some length, submitted to the mayor recently.

He makes five suggestions, as follows: Rehabilitate the physical property; secure new capital for improvements; provide for depreciation; reroute the entire system; provide adequate service. After suggesting this program he points out along what lines the traction situation may be expected to develop if a comprehensive program is worked out and adhered to.

In reviewing the present troubles, he states that they are traceable largely to the following causes: Excessive actual cost of property due to the lines having been rebuilt a number of times, and to expensive construction; nonpaying extensions, due to general overexpansion in the effort to keep out competition; over-capitalization; absence of a depreciation account; and a routing of cars that has been the result of development and not of design.

In referring to the prolonged struggle which will ensue if steps are not taken to solve the situation in an adequate way, the report concludes: The question for the city and for the company to decide at the present time is whether the struggle is worth while. Co-operation in the planning, building and operation of the system, publicity of plans and results and a fair division of the burdens and the benefits of operation would appear to be the best plan. One city, one system and adequate service is the object which should be worked for by all those charged with the responsibility of making decisions.

Electrification of Paris Railoads.

As a means of relieving the congestion of traffic, a problem of increasing difficulty, the government, it is reported, recently decided to electrify the belt railroad of Paris and the railway service out of St. Lazarre station. The estimated expenditure is $40,000,000.

BOOK REVIEWS.

"Railway Special Work." By Walter E. Silsbee and Percy E. Blood. New York: McGraw-Hill Book Company, 1910. Flexible leather, xi + 107 pp. (6¾ x 4⅛ inches) 82 diagrams. Supplied by the Electrical Review Publishing Company for $2.

This little book contains in compact form a mass of information of aid in the calculation of frog work and special curves for use in the shop. Methods for the solution of over eighty problems in special work are given, in many instances accompanied by numerical examples. After an introduction on the use of the slide rule, which is strongly urged by the authors, the use of logarithms is briefly discussed. Then follow some thirty-five problems in simple curves, a number of problems on clearances and a series on reversed curves. Tongue-switch special work, crossings, cross-overs for street railways, split-switch special work and cross-overs, wye problems and transition curves are treated successively in considerable detail. The book concludes with eleven useful tables, including logarithms of numbers in common use, several tables of chords, data for laying out small curves, radii and middle ordinates of railroad curves, frog-spreads, transition curves, switch-throws, and right-angled triangles.

"Auto-transformer Design." By Alfred H. Avery. London: E. & F. N. Spon, Limited, 1909. Cloth, 60 pp. (8½x5⅝ inches), 25 illustrations. Supplied by the Electrical Review Publishing Company for $1.50.

Auto-transformers are coming into more extensive use, particularly in connection with the use of low-voltage tungsten lamps. In England this practice is become so general that the author has developed a considerable business in the design and manufacture of auto-transformers. In writing on this subject, therefore, he does so from practical experience with all details in the making of this apparatus. As a result his book is a thoroughly practical book written in very simple language. The various steps in the design are clearly explained and reduced to the simplest possible terms. A typical example is carried through all the discussion so that the inter-relation of the magnetic and electrical features of the design is made evident. The chapter on constructional details gives a good idea of the assembling of the transformer. The only blemish in the book is a series of loose and partly misleading statements in the chapter on modern methods of illumination. While the method followed in the design is devoid of technical refinements, it is intentionally free from elaboration and suffices for the object aimed at.

"A Pathfinder: Discovery, Invention and Industry." New York: The Press Scrap Book, 1910. Flexible leather, 143 pp. (9½x6½ inches), one steel engraving.

This volume is the first of a series of educational biographical sketches of eminent inventors, and very properly has as its subject one of the pioneers of the greatest industry of modern times. Edward G. Acheson is the inventor of carborundum, artificial graphite oildag, aquadag and siloxicon. His connection with electrical affairs dates from the day in September, 1880, when he entered Edison's works at Menlo Park, although he had a year previously designed and had constructed a dynamo. Doctor Acheson's early inventive achievements, his experiences at the Edison works and in installing plants in Europe, and the development of the inventions which later became associated with his name, all form interesting chapters in the life of this captain of industry. The greater part of the volume is an autobiography, and the personal touch which comes from a recital in the first persons adds much to its interest. The introduction and concluding chapters are written by another hand. The typographical appearance of the volume is excellent.

"Electrotechnics." By John Henderson. London: Longmans, Green & Company, 1909. Cloth, xiv + 165 pp. (7¼x4⅞ inches) 38 illustrations. Supplied by the Electrical Review Publishing Company for $1.20.

This is a laboratory manual containing the outlines of eighty-seven experiments in what in this country would be called a course in electrical measurements. These notes in manuscript form have been the basis of the laboratory work of the evening students at the Borough Polytechnic Institute in London for several years past. This course of experiments covers the laboratory work of three years, the first elementary, the second dealing with direct currents and the third with alternating currents. The book does not give the theory of the tests and instruments involved in the work, the supposition being that the student will use a separate text on this subject. The directions for each experiment are intentionally given in brief so that the student will himself have to master the difficulties he encounters. In some instances the directions seems almost too brief, because it imposes too great a burden on the instructor to impress on his students continually the numerous precautions that must be observed with delicate instruments; if a laboratory manual is used these may well be incorporated in it. Among the more difficult experiments taken up in the book are several on the use of potentiometers, photometry of incandescent lamps, testing magnetic properties of iron, construction of standard cells, efficiency tests of a storage cell, calibration of a ballistic galvanometer, use of the Kelvin current balance, etc. The experiments given on dynamos and motors and on alternating-current characteristics are quite simple. At the end of the book are given many useful tables of logarithms, natural trigonometric functions, conversion tables and constants, wire tables, resistivities, etc. On the whole the book is an excellent guide for the laboratory work it aims to cover, what criticism may be offered being directed rather at the almost too ambitious character of the work proposed for evening students.

"Solenoids, Electromagnets and Electromagetic Windings." By Charles R. Underhill. New York: D. Van Nostrand Company. Cloth, 342 pages (5 by 7½ inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.

This book presents to the electrical industry concise data regarding the design of electromagnets. With a view to expanding the knowledge regarding the action of solenoids and electromagnets, the author made numerous tests covering a long period, by means of which data he had deduced laws which will prove of value to engineers and students, especially in view of the want of accurate data on this subject on account of the rapid development of remote electrical control and kindred electromechanical devices. The calculations are presented in detail so that the reader may easily follow the method of arriving at results. A large number of tables and charts are included in the book making it one which should be welcomed by the electrical profession and manufacturers of electrical apparatus alike.

"Electric Motors, their action, control and application." By Francis B. Crocker and Morton Arendt, New York: D. Van Nostrand Company. Cloth, 291 pages (6 by

9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.50.

Compared with the amount of literature on the design and construction of electrical apparatus, the operation of electrical machinery has received comparatively little attention. In this book the authors have presented to the electrical industry information that will undoubtedly prove useful to those who operate or are interested in the operation of electrical motors. The subject, as treated by the authors, is necessarily technical because it not only involves the mechanical factors, speed and torque but also the electrical quantities, voltage, current and flux. Any or all of these five quantities vary and are affected by other quantities or conditions. Hence, the problems are analyzed and solved with thoroughness to obtain results of real value, and while these operations prohibit a popular treatment of the subject, care has been taken to explain each step or result as clearly as possible and to illustrate each case, when possible, by a specific numerical example based upon standard commercial motors. The general method adopted in this work is based upon the consideration of counter electromotive force and its relation to impressed electromotive force as the important criterion of motor action.

Bids Wanted for Electrical Supplies.

The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., is asking for bids (opening August 30, 1910) on the following electrical supplies: 3,000 feet of telephone cable, 5,000 feet of copper conductor, 1,000 arc-lamp globes, all for delivery at the Brooklyn Navy Yard; and one turbo-generating set for the Charleston (S. C.) Navy Yard. The schedule numbers for the above are 2,811, 2,811, 2,815, and 2,815, respectively. Schedules may be obtained on application to the Bureau, or to the navy pay office nearest each navy yard.

Navy Department Awards Contracts.

The Navy Department has awarded the contract for supplying twelve sets of wireless telegraph apparatus for the Brooklyn Navy Yard to the National Electric Signal Company, of Pittsburg, at $45,341; and for six electric capstans for the Norfolk Navy Yard to the American Ship Windlass Company, of Providence, at $14,000. F.

Financial Reports of Electrical Companies.

Gross earnings of Massachusetts Electric during July showed an increase of $71,200, as compared with a decrease of $12,000 during June. For ten months gross earnings have increased $466,942, and there is little question that for the twelve months to September 30 the increase in gross earnings will reach $50,000, while that figure will probably be exceeded.

SCHENECTADY RAILWAY.

The report of the Schenectady Railway Company for the quarter ended June 30, 1910, compares as follows:

	1910	1909
Gross earnings	$294,558	$247,594
Net earnings	110,444	85,465
Other income	2,704	3,747
Total income	113,147	89,212
Surplus after charges	88,773	64,542

Interstate Commerce Commission Ruling.

In the recent decision in the matter of the complaint of the Commercial Club, Traffic Bureau, of Salt Lake City, Utah, against the Atchison, Topeka & Santa Fé Railway Company, *et al.*, before the Interstate Commerce Commission, the following rates among others, were brought into issue:

West bound commodity rates from Chicago, the Mississippi River and the Missouri River, to Salt Lake City.

East bound rates on certain products of Utah to the Missouri River, the Mississippi River, and Chicago.

Passenger fares in both directions between Salt Lake City, Ogden, and Provo, on the one hand, and Denver, Omaha, Los Angeles, San Francisco and Portland, upon the other.

The findings of the Commission have been, in part, as follows:

Present westbound commodity rates from the above named eastern points of origin to Utah common points are found to be unreasonable to the extent which they exceed those which are named below.

Present eastbound rates on certain products of Utah to the Missouri River, the Mississippi River, and Chicago are found to be unreasonable to the extent that they exceed those named below.

In this case, as in the Spokane case, it has been decided that no order changing the rates will be made at the present time, but during the months of July, August and September, accurate accounts must be kept showing the difference between the receipts upon traffic actually moved under the present rates and what those receipts would have been on the same traffic had the rates proposed below been in effect.

Either party may, on or before August 15, 1910, file with the Commission any objection to the rates found by this decision to be reasonable, but not yet made the subject of an order; and in this, as in the Spokane case, it is hoped that matters will be in shape for final adjustment by November 1, 1910.

In the commodity rates named, three territories are observed: Missouri River and common points, designated as "Missouri River;" Mississippi River and common points, as "Mississippi River," and Chicago and common points, as "Chicago."

Among the rates named are the following:

	From Chicago	From Mississippi River.	From Missouri River.
Insulators, terra cotta, clay, glass, or porcelain, including insulators similar to conduits for use in buildings for protection against fire; telegraph pins and brackets, in boxes, barrels, crates or hogsheads, minimum carload weight, 30,000 pounds	90	86	72
Anchor rods for telegraph or telephone poles, minimum carload weight, 30,000 pounds	80	77	64

Copper Market.

A recent item from the Wall Street Journal states that the copper market continues firm and sales are holding up fairly well, most of the business being done on a basis of twelve and five-eighths cents a pound. Producers believe copper will be selling above thirteen cents before the close of the month.

In addition to the sale of 12,000,000 pounds made to a western corporation recently an eastern concern has taken 8,000,000 pounds on a basis of twelve and five-eighths cents. Total sales of the metal since the buying movement began are estimated at close to 100,000,000 pounds. Of that amount the United Metals Selling Company has sold about 60,000,000 pounds.

Electric Combinations in Germany.

It is reported by the *Frankfurter Zeitung* that negotiations are proceeding between the Berlin General Electric Company and the Felten & Guilleaume-Lahmeyer Werke, Mulheim, with a view to forming a close working agreement between these two important German electrical undertakings.

New Electrical and Mechanical Apparatus and Appliances.

General Electric Speed Controllers.

The General Electric Company's type CR-164 speed-controlling rheostats are so designed that they combine in a single box both armature and field regulating rheostats, and all speed changes are effected by movements of a single rheostat arm, which is automatically held in any position by a mechanical device. The line includes rheostats designed for "machine tool" service where full-load current is taken at the lower speeds in order that the motors may maintain a constant torque, and also for "fan" service where load increases with speed.

For protection from failure of voltage and the consequent danger of power being again thrown on the line without resistance in series with the motor armature, they are provided with a no-voltage release attachment. Upon failure of the voltage, the retaining magnet is demagnetized, releasing the arm and a spring instantly returns it to the off position, making it absolutely impossible to close the armature circuit without cutting in all the armature controlling resistance. The no-voltage release coil is connected directly across the line in series with a resistance and is thus independent of the current of the motor field and

SPEED-CONTROLLING RHEOSTAT.

will protect any motor with which this rheostat may be used.

The contact segments are of liberal size and so designed that they may be very easily and quickly renewed. The resistance units are of an improved design so constructed as to be non-fragile and thoroughly ventilated.

Type CR-165 rheostats are the CR-164 rheostats described above with the addition of an overload release coil.

Roller-Smith Fault Spotters.

The Roller-Smith fault spotter, shown herewith is a special form of slide-wire bridge in which the slide wire itself, instead of being stretched out straight and of low resistance, is

ROLLER-SMITH FAULT SPOTTER.

wound spirally around a mandrel of insulating material, which mandrel is itself bent into the shape of a circle. By this expedient there is made feasible the use of a wire length in excess of that in any conventional bridge and in consequence there is a slide wire resistance of over 200 ohms. With a slide wire having a resistance as high as this, the sensibility of the apparatus and consequently the accuracy with which measurements may be made in the ordinary run of testing encountered in telegraph and telephone practice is greatly enhanced.

The slide wire above described is mounted underneath the top plate of the instrument where it and the contact movable thereon by turning the central hard rubber button are protected from damage and kept free from dirt.

The fault spotters are made in two styles, one of them, the "Galvanometer Model," having self-contained batteries and a high sensibility d'Arsonval galvanometer, the other, the "Plain Model," which has neither batteries nor galvanometer, but which is supplied with terminal posts so that an external current source and external means of detecting balance (generally a telephone receiver) may be employed. The galvanometer of the "Galvanometer Model" is permanently secured within the casing, the top plate and the batteries being removable without disturbing it or touching any wiring connections. It is equipped with a zero adjuster operable from the outside of the case.

The plain model has a push button key in the circuit to the external means of current detection so that if a telephone receiver is used for that purpose, manipulating this key will cause the clicking necessary with this mode of working.

These instruments are made by the Roller-Smith Company, 203 Broadway, New York, N. Y.

Novel Advertising Scheme Attracts Attention.

The effectiveness of reflecting current events into advertising was well proven by the Baltimore office of the Westinghouse Electric and Manufacturing Company, who enacted in miniature in its show window the Jeffries-Johnson fight.

Two light rubber balls decorated in white and black, respectively, were made to dance back and forth in a diminutive arena. Their energy was imparted to them by the breeze of an eight-inch fan below a screen in the center of the arena. The balls were driven to the rail by the shaft and bounced merrily back to bump into each other in the center.

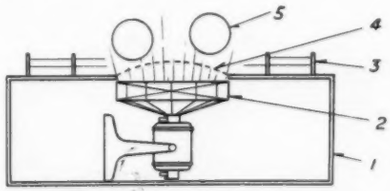


DIAGRAM OF ADVERTISING DEVICE.

The exhibition drew a constant crowd, and was very effective in calling attention to the window display of Westinghouse fans.

Copper Exports.

Exports of copper for the week ended July 14, were 4,325 tons, as compared with 12,986 tons last year, and 10,343 since July 1, as compared with 18,968 last year.

Carborundum Lightning-Arresters.

A new type of lightning-arrester using a block of carborundum in place of an air gap has been introduced for use on telegraph and telephone train-dispatching circuits. The carborundum is mounted between carbon electrodes and has a high enough resistance to prevent leakage of line current to ground, athough it readily permits static charges or heavy charges induced by lightning to pass through to ground.

A number of these arresters when installed on railway dispatching circuits quickly showed that they are superior to the air-gap type of arrester in eliminating the sharp annoying clicks in the receiving instruments that are caused by static charges on the line. As these arresters do not employ a porcelain or slate base they are more substantial and less liable to breakage.

These arresters are known as "Brach" types No. 20 and No. 21. They are made by the L. S. Brach Supply Company, 143 Liberty Street, New York City.

Ingenious Electrical Device.

There has recently been placed upon the European markets a switch which gives seven, or more, variations of energy and economizes the voltage proportionately to the power used. The different degrees of economy are reflected by the meter with precision and the power is under absolute control.

The device can be used in place of, or in conjunction with the existing switch and it is said, will effect a material saving in current when used for domestic purposes.

Schug Generating Outfits.

The constantly increasing demand for small lighting and power units for use in launches, country homes, isolated factories, etc., has induced the Schug Electric Company, Detroit, Mich., to bring out an exceedingly simple, reliable and efficient line for such service.

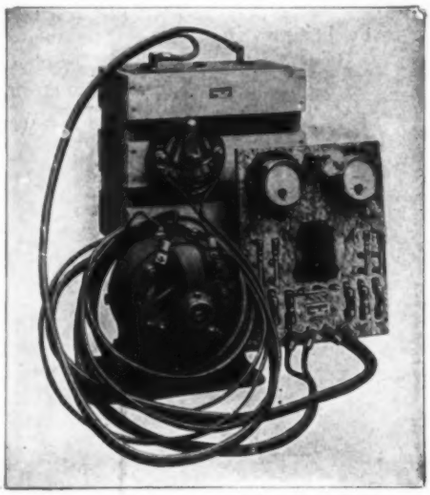


FIG. 1.—LIGHTING SET, COMPLETE.

The generators are made either multipolar or bipolar, according to the size, and are furnished in various capacities and in voltages ranging from ten to 110 volts. These generators have self-oiling bearings and sliding bases and are fitted with a large commutator and high-duty graphite carbon brushes. In short, the entire design of this generator has been very carefully worked out, and the manufacturer guarantees them to give perfect satisfaction.

Fig. 2 is a view of the generator supplied with these outfits. Fig. 1 illustrates a complete low-voltage outfit, including the well-known Schug storage battery, which is used in connection with it.

A low-voltage system frequently possesses advantages over other systems due to the low initial cost, simple switchboard arrangement, small number of battery cells, etc., and at the same time is easy to operate. The use same time is easy to operate.

The Energy Used in Telephone Service.

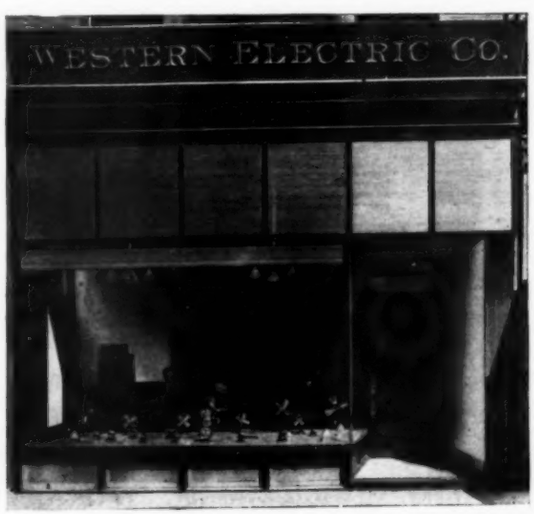
From careful tests conducted by the New York Telephone Company it has been found that the handling of one million messages requires the expenditure of 900 kilowatt-hours of electrical energy on the average.

New Western Electric Headquarters in Milwaukee.

The new Western Electric headquarters in Milwaukee was formally opened on July 28. The store, which is located at 378 East Water Street, is one of the finest equipped electrical supply stores in Milwaukee.

The accompanying illustration shows the exterior of the new store, which is a four-story and basement building devoted exclusively to displaying and storing telephone and power apparatus and electrical supplies of every description. The growth of business in Milwaukee led to the establishment of the fine new quarters.

FIG. 2.—SCHUG GENERATOR.



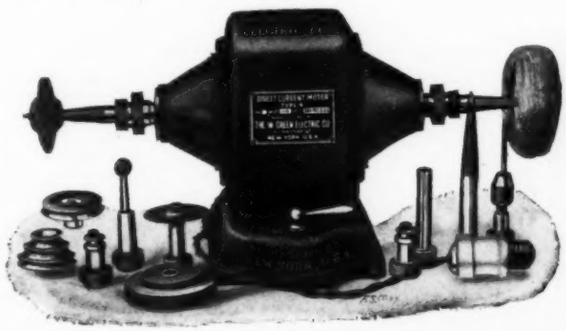
WESTERN ELECTRIC STORE IN MILWAUKEE.

Green Polishing and Buffing Motors.

The W. Green Electric Company, 81 Nassau Street, New York, N. Y., having been awarded the government contract for several polishing and buffing motors to be used in the new torpedo station at Newport, R. I., reports that upon the completion of this order the machines were passed by the United States Board of Inspection as meeting every requirement.

The Green polishing and buffing motor is made for use on both alternating and direct-current circuits. The motor is self-starting, noiseless in operation, enclosed so as to be dust and waterproof and is portable. It is equipped with patented interlocking chucks, adjustable to either the right or left side of the shaft. The speed controller is contained in the base of the motor, as shown in the accompanying illustration.

These machines may be instantly attached to any incandescent lamp socket or power circuit and are always ready for use. The cut illustrates brush and buffing wheels on spindles in position, also the drilling, grinding, burr, emery, sandpaper, saw and lap chucks, extra long buffing spindle, single and three-cone pulleys, grindstones and adjustable plug and cord.



GREEN BUFFING AND POLISHING MOTOR.

The Green motor is made in sizes ranging from one-seventh horsepower to two horsepower and is supplied in either variable or constant-speed types.

That the General Electric Company is convinced of the smokeless operation and high efficiency of the Taylor gravity-underfeed stoker is shown by a third order received recently by the American Ship Windless Company, Providence, R. I. This order is for two six-retort stokers to be used under two 525-horsepower Stirling boilers in its plant at Pittsfield, Mass.

The New Telephone Exchange at Kalispell, Mont.

A complete new common battery telephone system has recently been installed by the Western Electric Company at Kalispell, Montana, for the Northern Idaho and Montana Power Company. With the completion of this plant the community of Kalispell is provided with an up-to-date, efficient telephone system which will give service comparable in every way with that in the largest cities.

The new installation comprises a subscribers' switchboard, wire chief's desk and chief operator's desk. All equipment for completing long-distance connections, power plant for supplying energy to the system and outside construction, including poles, lead cable, wire and subscribers' sets.

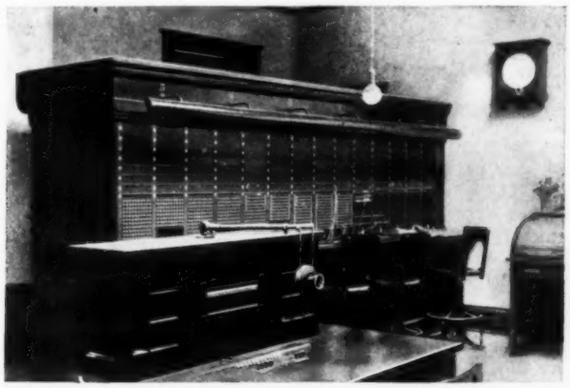
The subscribers' board consists of two sections of standard Western Electric No. 1 equipment, having seven panels and three operators per section. Four operators' positions are used for taking care of the local subscribers' service, while one operator handles toll and rural calls. The switchbard is capable of accommodating 4,600 subscribers' lines, fifty rural lines and toll and pay station lines.

The exterior of the switchboard, which is constructed of Brazilian mahogany, highly polished, makes it an ornament in the remodeled telephone quarters of the Northern Idaho and Montana Power Company.

The woodwork of the chief operator's desk is made to match that of the subscribers' switchboard. This desk is provided with lines for connection to the switchboard for properly supervising the work of the operators, receiving complaints from subscribers and giving the operator means for determining the cause of complaint by listening on the circuit of any subscriber or operator without their knowledge and ascertaining the deportment of both while conversing. Trunk circuits to other parts of the telephone system are provided, enabling the chief operator to secure immediate connection with the manager's department, the wire chief's desk, etc.

Testing circuits and plugging-up lines sufficient to permit trouble to be rapidly cleared up have been arranged on the wire chief's desk. All tests can be made with accuracy, ease and dispatch. Trunk lines connect the various parts of the telephone system with this desk, bringing the wire chief into immediate touch with any part of the system.

In the terminal room the arrangement of the many wires has been made so as to reduce to a minimum the possibility of trouble and to facilitate the clearing up of any trouble.



CHIEF OPERATOR'S AND SUBSCRIBERS' SWITCHBOARD.

The power plant consists of a twenty four-volt storage battery for the local supply and forty-eight-volt storage batteries for the toll supply, with a gas-engine-driven charging generator for supplying energy to the batteries. This charging generator is one of a special construction, designed for the charging of storage batteries without introducing magnetic and commutating noises on the telephone circuits. In the event of any accident to the storage batteries the exchange may be supplied with power direct from the machine without any noise interfering with transmission.

The storage battery has sufficient capacity to carry the exchange a number of hours in case anything should happen to disable this generator. Dupli-

cate ringing outfits were furnished for the telephone system and connected to separate circuits.

In laying out this telephone equipment extra precautions were taken because of the network of wires carrying electric current of both high and low potentials in and around Kalispell. It is necessary to protect the apparatus, subscribers and employes against these currents as well as against lightning. A wall type frame is furnished and on this the subscribers' lines terminate, continuing through the cable to the main distributing frame. Entering the main distributing frame on the horizontal side the lines are carried through the frame by means of jumper wires to the switchboard or arrester side, where they are further protected from sneak currents and heavy lightning discharges by means of heat coils and lightning arresters. This gives absolute protection against any outside disturbing currents, whether of large or small proportion or whether static or dynamic in character.

The New Harrison Aertube Heater.

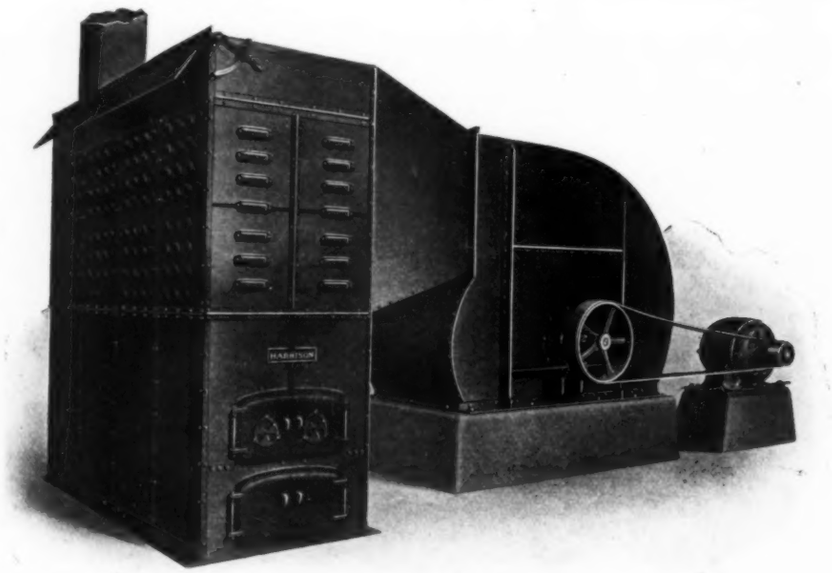
A new direct fuel-to-air heater system, known as the harrison aertube heater system is being placed on the market and is meeting with great success. The reasons for this are evident from the plan of the Harrison heater. The hot gas from the fire strikes directly on the heating tubes, and is distributed among these by baffle plates. The transfer of the heat of the fire to the air passing through the tubes is direct and immediate. It begins just as soon as the fire is started.

While the Harrison system is applicable in any type of building, it is especially satisfactory where the heating system must also provide mechanical ventilation, as in schools, churches, theaters and other buildings of more or less public character. It is particularly adapted to buildings which do not require steam for power purposes, but which have electric power, such as car-barns; and also for factories with hydroelectric power. It serves particularly well in garages, where the gathering of explosive vapors must be prevented; and equally well where dust needs to be cleared from the air.

The Harrison aertube heater is made in tubular units or sections of thirty-two tubes each, the tubes being four inches in diameter, four feet long, and supported at the ends in cast-iron tube plates. The patent joint between each tube end and the tube sheet consists of a ring of molded composition packing held in place by a cast-iron expansion ring. It is flexible enough to allow for expansion and contraction, yet absolutely prevents any gas from the furnace getting into the air. The different parts of the casing are jointed on the same plan, the composition packing being held in place by cover plates held by through bolts.

Maintenance cost of the Harrison heater is low, since the parts are all of standard sizes and interchangeable. Consequently the average mechanic can very quickly make the few repairs that may be needed. Such need is rare because of the durability of the cast iron sections, and the fact that the tubes are more lasting than any others previously constructed of light weight material. The aertube heater is the only one of this type on which repairs can be made while it is in operation.

Fuel adaptibility is another particularly strong feature of the Harrison aertube. While coal is the usual fuel, the aertube works remarkably well on the exhaust from gas engines, from forges, ovens and the like; and such otherwise waste heat can if necessary be used in combination with the burning of fuel on the grate to make up any deficiency. Crude oil gives excellent results. Producer gas is a highly satisfactory fuel when a group of buildings is to be heated, since the gas can be piped from a central producer to aertube heaters in the various buildings.



NEW HARRISON AERTUBE HEATER.

A Radium Safe.

A remarkable safe, the first of its kind ever constructed, has been made by an English firm of safemakers for the British Radium Corporation. It has been specially constructed for the storage and protection of radium, and though only about three feet in height it weighs a ton and a half. Great ingenuity has been exercised upon the design and construction in order to make it, as far as possible, proof against the skill of the most expert burglars and against all risks of loss by reason of emanation.

Officials of Federal Sign System Hold Convention.

The first annual Convention of the Federal Sign System (Electric) was held at the Hotel Moraine, Highland Park, Ill., August 4, 5 and 6.

A very enthusiastic gathering of the company's officers and branch office managers was the result. Business sessions were held each day, and a banquet was given on Friday evening, at which nearly fifty persons were seated at the table.

The enthusiasm shown at the convention was the keynote of the company's rapid growth, and prophesied increased success for the future.

Current Electrical News

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, AUGUST 5, 1910.—In the Jura region of France and near the Swiss frontier there is to be installed a light electric railroad, which will be of interest in many ways. Owing to the mountainous character of this region the new line is likely to prove very attractive to tourists. The railroad is to be built from Bellegarde, one of the principal stations on the Paris-Lyons-Mediterranean railroad system running to Geneva, and the locality of Chezery, passing by the communes of Lancrans and Confort. Considerable engineering work in the way of viaducts, bridges and embankments will be needed here. Among the bridges I may mention the Montanges bridge, which has a single span of 260 feet and a height of 202 feet. The road winds around the rocky heights of the Jura for most of its course and ends at a point near the Valserine stream, upon which a turbine plant will be erected for supplying the current. The flume leading from the dam is partly to be cut in the rock and in part of reinforced concrete. For the first part of the plant the Thomson-Houston Company is to furnish two direct-current generators of 500-horsepower each.

St. Menchould, France, as well as the town of Aloxe-Corton, is to have electric lighting plants installed. The commune of Gaillac is considering a project for combined gas and electric lighting. For the docks of the canal which connects the town of Caen with the English Channel there will be used electric lighting to a considerable extent. This includes the basins of the canal which are located at Caen and also a portion of the canal proper.

In the Pere Lachaise station of the Paris subway there has been installed a rolling staircase, which takes the passengers up to the surface. Where the subway runs at a considerable depth below the ground, as is the case at some points, there are many stairs to climb, and this is recognized as a disadvantage. The company is, therefore, making tests of the rolling staircase in order to find out in just what way to apply it at the stations in which it is most needed. The present system appears to work very well.

Electric traction is to be used on a section of the state railroads in Baden, Germany. The section extends from Freilassing to Berchtergaden, and it has been decided to erect a turbine plant at Reichenhall, one of the stations of the line. Power is to be secured from the Saalach stream, and the plans call for the installing of four turbine units of 2,500 horsepower each. The turbines are built by the Berglieb-Hansen firm and are to work upon a head of water of fifty-five feet.

Concerning the project for electric traction lines in the region of Bayonne, France, lying near the Pyrenees and the Spanish frontier, it has now been decided to construct several lines which will connect the important localities of the sea-coast region and will make a complete circuit. Starting from Bayonne, there will be a line running to the well-known watering place of Biarritz and from thence to Hendaye. The remainder of the system takes in the localities of St. Jean de Luz, Peyrehorade and Cambo, returning to Bayonne.

In Austro-Hungary the town of Gries is taking measures to erect an electric incline which will mount one of the adjacent heights. An electric railroad will be constructed which is to start from Dunakesz and will take in a number of communes. Another electric line is to run between the towns of Miscolcz and Hejöcsaba. From Hainsbach, a station on the Austrian state railroads (Böhmer railroad) an electric line will be built as far as Hielgersdorf. It is to be a standard-gauge railroad and will run by way of Lobendau.

A. de C.

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JULY 29.—At the joint meeting of the British and American Institutions of Mechanical Engineers in London, five papers were presented upon the question of the electrification of railways, and the result of hearing these and the discussion upon them leaves one's thought upon the matter somewhat confused. George Westinghouse in his paper pleaded for the evolution of one system of electric traction which could be universally adopted, and favored single-phase installations. W. B. Potter prophesied that the high-tension continuous-current system, up to say 2,000 volts, would practically supersede all others, and predicted that the single-phase system would soon be abandoned in America, while H. N. Hobart presented an elaborate series of comparative figures to show how much better continuous current at 600 volts was than single-phase. Then Mr. Scott of America suggested that Mr. Hobart's conclusions were not wholly reliable because certain of his assumptions were inaccurate, and within the next few minutes a telegram was received from Philip Dawson, regretting his inability to be present and refute Mr. Hobart's conclusions. Later, a railway manager rose to suggest that it was better not to have a standard system because heavy suburban passenger traffic needed different treatment to heavy freight traffic. Taking all things, not very much progress was made towards arriving at a standard system.

The supply of fittings and the wiring of houses by municipalities owning electric plants is still occupying a good deal of attention, and municipalities generally are being asked to support the promotion of a bill in Parliament next season giving them such powers.

A line of tramways, in which two trolley wires are used for each track, has been opened in London by the London County Council. This system had to be adopted on account of the objections of the Admiralty in respect of Greenwich observatory. In connection with tramways within a certain defined radius of the observatory, the Admiralty was granted an absolute veto in imposing its own conditions upon which they shall be constructed. A clause to this effect has been inserted in the London County Council tramways bill of this session.

The action against the West Ham corporation in which it was charged with having illegally borrowed certain sums of money for the electricity undertaking, has resulted in a decision adverse to the corporation. The only effect is that the Local Government Board will now have to legalize these borrowings, for as the overdrafts on the bank, which constituted the borrowings in question, have been repaid, there is no question of having to refund moneys borrowed.

The continued success of the single-phase system of electric traction on the South London line is an interesting answer to those in this country who are continually decrying this method of electric traction. So satisfied with the system are the directors of the London, Brighton and South Coast Railway that considerable extensions have actually been started, and it was announced at the half yearly meeting of the railway company that as a result of these extensions a new arrangement had been made with the electric supply company which will bring about considerable reduction in the cost of electrical energy.

Two 3,000-kilowatt Curtis turbines have just been added to the Bradford Corporation electricity works.

The Middlesex County Council, which owns an extensive system of electric tramways in its county, is proposing to use the trackless trolley system in certain districts where the roads are narrow, and the cost of widening would be prohibitive.

An interesting experiment with telephoning to a train in motion has been carried out between London and Brighton by H. von Kramer. The system is really an induction wireless system, although wires are laid along the track. A large coil encircles one coach, the track wires being parallel with the running rails. Speech was maintained between a signal box and the train while the latter was running at full speed. It is said that the fifty miles of line between London and Brighton is to be equipped with the system in a few months' time.

Objection is being offered by the North of England Steamship Owners Association to the proposal to render wireless installations compulsory upon all ships carrying fifty or more passengers. G.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., AUGUST 13.—It is announced that the Healey Falls Development Company has sold its property at Healey Falls, near Belleville, Ont., to the Seymour Electric Power Company and that the latter company will develop the water power at that point.

Although the new power development of the Sherbrooke Railway and Power Company, of Sherbrooke, Quebec, has only been under construction since the first of July last, it is stated that the officials of the company have already found that they will not have enough electrical power to meet the demands for it in and about the city of Sherbrooke. As a result they are now negotiating for the purchase of another power on the St. Francis River, near the city. This power will double the supply.

The city of Windsor, Ont., is advertising for sale the surplus of the Niagara power that it expects to receive but will not require for its own use. It is to get from the Ontario Hydroelectric Commission about 15,000 horsepower, of which it will need not more than 2,000 horsepower. It is expected that the balance will be sold to the Tunnel company for international use and to Detroit manufacturers. The question of allowing this export of power to Detroit has therefore reached the point where a decision on the part of the provincial government cannot be long delayed. The consent of the Dominion government will also have to be obtained.

The difficulty concerning the water powers along the line of

the Trent Valley canal has been settled by the department of railways and canals here. Numerous concerns sought the powers, but those to whom they have been assigned secure them on condition that certain lands required for canal purposes be acquired, and also that the department be relieved of liability for damages for flooding of lands. At dam No. 2 the power goes to the Trent Power Company or the Seymour Power Company, to be arranged between themselves. The rate is to be determined, and for the town of Trenton 500 horsepower is to be reserved. At dam No. 1 the power is to be allotted free to the Trenton Power Company, the Trenton Electric Light Company and the town of Trenton.

The construction of the Ontario Hydroelectric Commission's power transmission line from Niagara Falls is being pushed ahead with all speed. It is said that when the line is completed there will be over 3,000 miles of cable. Of this more than 800 miles have already been put in place. Some 150 men are now employed on cable work. The wires have been placed over the Welland Canal and the line completed between the Falls and Dundas, a distance of sixty miles, over which are strung ten cables, making 600 miles of steel and aluminum cables for the conduct of power and the arrest of lightning. From Watertown to Berlin, a distance of thirty-five miles, six cables have been strung, or 250 miles.

W.

COMMISSION NEWS FROM NEW YORK.

The New York Public Service Commission, second district, has granted the petition of the Black River Traction Company for permission to extend its line within the city of Watertown. The new line as authorized will extend from the present terminus at the intersection of Pearl and Water streets in the city of Watertown through Pearl street a distance of 3,150 feet to a point opposite the plant of the Massey Machine Company. The traction company has obtained the necessary consent of property owners and a franchise for such construction from the city of Watertown, which franchise has been approved by the Commission according to law. There is a public demand and necessity for the proposed extension, which will accommodate a large number of employees of the New York Air Brake Company and the Massey Machine Company.

The Commission has received an application from the Fonda, Johnstown and Gloversville Railroad Company for leave to issue the balance of its unissued bonds under its fifty-year first consolidated general refunding mortgage of January 14, 1903, the proceeds of the proposed issue of bonds to be used to pay for additions, extensions and improvements to the company's line.

The Commission has also received a petition from the Rochester Belt Line Railroad Company for a certificate of convenience and necessity and for permission to construct its road, fifteen miles in length, operated both by steam and electricity, and to be mainly a freight belt line connecting all railroads at Rochester; for permission to exercise franchises and for a determination as to the manner of crossing the streets, avenues and highways proposed to be crossed by it.

The commission has served upon the New York State Railways the complaint of Morris Manson, of Rochester, as to alleged refusal of that company to carry certain newspapers in packages upon its cars in the city of Rochester for complainant. The complainant alleges that the company has filed its tariff with the Commission stating that newspapers in packages printed and issued in the city of Rochester will be carried on all cars at twenty-five cents per 100 pounds and that this tariff is now in effect. Subsequent to the time this tariff became effective the New York State Railways has continued to carry all such newspapers at that rate, but has refused absolutely under any conditions whatever to carry any other newspapers. The complainant states that he is the circulation manager or distributing agent for certain out-of-town newspapers, and has contracts with them in and by which he receives a certain percentage of the sales made within the city of Rochester and that the discrimination in the new tariff affects no one but himself as he is the only person interested in having newspapers carried on cars, outside of the Rochester newspapers.

WISCONSIN COMMISSION NEWS.

The Commission has granted the application of the Milwaukee and Fox River Valley Railway Company for a certificate of convenience and necessity. This certificate gives the company authority to proceed with the construction and operation of a street and interurban electric railway which will connect Milwaukee with the cities of Cedarburg, Newburg, Plymouth, Elkhart, Chilton, Appleton, Fond du Lac, Kaukauna and Menasha. The petition for the certificate was opposed by the Milwaukee Northern Electric Railway. The new road will invade the Northern's profitable field in Cedarburg and in some of the territory between Cedarburg and Milwaukee. Considerable testimony was introduced to show that the new road could not be a commercial success.

The Commission in its decision stated: "After carefully considering the different estimates of the cost of construction, the volume of traffic, and the revenues to be derived therefrom, we are of the opinion that, while the project doubtless involves many uncertainties, these uncertainties do not create a risk of such magnitude as to justify this Commission in refusing the applicants the privilege of assuming it."

The possibilities of a rate war between the projected line and the objectors was repeatedly touched upon during the hearings. Such a possibility unquestionably exists but it is within the province and power of the Commission to prevent such a rate war and to compel the competitors to charge such a rate as will be reasonable under all the circumstances. It was made clear by the Commission that such authority would be exercised if occasion arose.

The Commission has authorized the Badger Railway and Light Company to issue 100 shares of common stock of the par value of $100.00 each. The purposes for which the stock is to be issued are to supply the company with funds for defraying the ordinary expenses of its organization and for making the necessary surveys of a line of railway which it proposes to construct from the city of Whitewater to the city of Lake Geneva, Wisconsin, and for the doing of other things necessary for making an application for a certificate of convenience and necessity. The company is ordered to file with the Commission verified statements showing the entire proceeds of the stock sale and showing in detail the items to which the entire proceeds of the sale of stock are applied.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

WEBER RIVER AQUEDUCT TESTED.—The engineers and contractors of the Utah Light and Railway Company recently made a test of the aqueduct which will be used in connection the 5,000-horsepower electric plant near the mouth of Weber Canyon. The dam at the head of the conduit is also made of concrete and reinforced with steel. It spans the river at a point where it is 100 feet wide, the dam being twenty-seven feet wide across the bottom and fourteen feet high. The gates regulating the flow of the waters of the river into the conduit and through the dam are regulated by adequate machinery placed in the interior of the dam. Every precautionary measure against the flood water season has been taken, and it is said by engineers that the dam is capable of controlling all the waters that can possibly flow down the Weber River channel. The power plant is to be started in the near future.

LIGHTING AND POWER.

(Special Correspondence.)

CALMAR, IA.—C. Miller & Son, of Clermont, have been granted an electric-light franchise here.

NASHVILLE, ARK.—The J. C. Stephenson Lumber Company is to furnish electric lights for this city.

WOODWARD, OKLA.—This city will vote August 17 on a bond issue of $30,000 for an electric light plant. P.

DONNA, TEX.—The Donna Gin and Power Company has been incorporated with a capital stock of $8,000. P.

UVALDE, TEX.—The new street lights have been installed and Uvalda is now well lighted by electricity.

ELGIN, TEX.—An electric light plant giving both day and night service was recently put in operation here.

RIPLEY, TENN.—The new dynamo has been installed at the plant of the Ripley Light, Water and Ice Company.

REDFIELD, S. D.—The council is about to let the contract for new boilers for the municipal electric light plant. C.

COLERIDGE, NEB.—This city has let the contract for a complete electric light plant to Foog & Ryan, of Sioux City. P.

JEWELL, IOWA.—The Ames Engineering Company, which has the franchise, will soon construct an electric light plant. C.

CRAWFORDSVILLE, IND.—Work on the construction of the buildings of the electric-light plant is now being pushed rapidly.

NASHVILLE, TENN.—The Watauga Power Company has been authorized to increase its capital stock from $150,000 to $300,000.

DES MOINES, IOWA.—The improvement leagues of East Des Moines are agitating for the erection of a new electric lighting system. C.

HUMBOLDT, KAN.—The Stevens Electric Company, of Coffeyville, has the contract to put in the electric light plant in this city. P.

NEW CONCORD, O.—The new electric light plant is progressing nicely and will probably be completed before the first of September.

PIERRE, S. D.—A power plant is being planned near Spearfish. It is proposed to tap the creek and carry the water through a tunnel to the generating plant.

PORT BYRON, N. Y.—This village is being wired and will be lighted by electricity. The work, which is in charge of G. Sweet, of Utica, will cost approximately $7,000.

CRESSON, PA.—On August 5 the plant of the Cresson Electric Company was destroyed by fire with a loss of about $100,000. Electric light service cannot be restored for a month or more.

FAIRMONT, MINN.—An ordinance has been passed by the council providing for the issuance of bonds for $30,000 for the improvement of the electric light and water works systems. C.

GYPSUM, KAN.—The machinery for the new electric-light plant has arrived and is being put in place. It is the company's intention to have the plant in operation by the latter part of this month.

CLEVELAND, OHIO.—The Reserve Electric Company, of Cleveland, has been incorporated with a capital of $10,000; by W. F. Brooks, H. Craig, C. Raber, William J. Wilson, R. M. Zimmerman.

BLOOMINGTON, ILL.—An electric-light plant is being installed in the Catholic church at St. Joseph. About 200 bulbs are to be used at the main altar, besides the lights of the main room.

RICHMOND, VA.—The work of laying conduits to carry wires for the ornamental illumination of Broad Street was begun recently. Each block is to have three ornamental iron poles carrying five lights.

NANVOO, IA.—The Carthage Electric Light Company has let the contract for an entire new plant equipment. The new generator which is to be installed is a 125-kilowatt, 2,300-volt, alternating-current machine.

LONGUERIEL, CAN.—The electric-light plant was put in service a short time ago and the city is now lighted by electricity. On the same day that the light plant was started the railway system was put in operation.

DEVINE, TEX.—The citizens of this place are offering a cash bonus for the location of a lighting plant here. Fenemen and Burnett have signified their intention of building this plant and will probably commence work soon.

STREATOR, ILL.—The Illinois Light and Power Company is considering the erection of a plant in this city but there is trouble about finding a sufficient water supply. A plant such as is proposed would cost about $500,000.

LAKE GENEVA, WIS.—The Lake Geneva and Lake Delavan Electric Company has been incorporated by H. T. Windsor, L. C. Church, W. D. Church, L. R. Roban and H. H. Lawrence. The company has a capital stock of $25,000.

BURLINGAME, KAN.—The city of Burlingame, Kan., is remodeling the electric light plant. It expects to start a day service and provide for the mines. Prof. B. F. Eyer of the State Agricultural college is the advising engineer.

THIRODAUX, LA.—The town will soon build a new municipal electric light plant. The town is said to have set a sufficient amount aside from the collection of liquor licenses to pay for the improvement out of the general fund.

SPOKANE, WASH.—The Washington Machinery and Power Company is preparing to add an additional story to its present building. The capital of the company will probably be increased from $25,000 to $125,000 before this is done.

HUNTINGSBURG, IND.—The Huntingsburg Electric Light Company has been incorporated with a capital of $15,000, to supply municipal and domestic lighting. The incorporators are Charles Meissner, August Meissner and F. G. Katerhenry.

OKLAHOMA CITY, OKLA.—Artistic lamp posts have been erected along Grand Avenue of this city and are now in service. Although these posts are at present in use on only one street, it is expected that the entire city will soon be lighted in this manner.

MASON, MICH.—The Mason electric light and water board has decided to replace all the arc lights in the city with tungsten lamps. A new generator will also be installed. Improvements amounting to $3,407.76 were put on the plant during the past year.

TIPTONVILLE, TENN.—A charter has been granted to the Tiptonville Light and Power Company of Lake County. The company has a capital stock of $7,500, with the following incorporators: A. E. Markham, R. S. Wright, J. P. Alexander, F. J. Caldwell and J. T. Burnett.

LIVINGSTON, ALA.—The Livingston Light and Improvement Company, of Livingston, has been incorporated with an authorized capital stock of $5,000 fully paid in. The incorporators are: J. A. McConnell, P. B. Jamison, J. O. Phillips, M. E. McConnell, C. H. Brock, and J. W. McBeth.

MILTON, PA.—On August 3, the light plant and machinery belonging to the United Power and Light Company, was destroyed by fire. The fire resulted from the short circuiting of a railroad generator which grounded, setting fire to the building. The company's loss is estimated at $30,000.

LOUISVILLE, KY.—A new electrical power plant is being installed in the basement of the Federal building which, when completed, will give sufficient additional power to operate the two electrical elevators. With the completion of the new power plant the lighting facilities of the building will be greatly strengthened.

THURMONT, IND.—The electric light plant, which was recently built here, has been taken over by the city and will be operated as a municipal plant. The plant was built at an expense of about $20,000 and is of approximately 200-kilowatt capacity. Waterpower supplied from a stream with a fall of 115 feet supplies the necessary energy.

MODESTO, CAL.—Deeds have been filed transferring the power plans, power line, equipment, etc., of the San Joaquin Canal and Irrigation Company, known locally as the "Tulloch Compay," from C. T. Tulloch to C. N. Black, of San Francisco. Extensive improvements, which will be announced later, are contemplated by the new company.

OGDEN, U.—Because of the refusal of the farmers to permit the water flowing into their irrigation canals to be shut off for twenty-four hours the Weber Canyon Power Company cannot start its big power plant, which was recently completed. The company has a large intake, but the shallowness of the water above the dam will not permit the water to reach the intake.

TUXEDO, N. J.—A lighting line is being extended from the proposed electric line at Turners to Sterlington, a distance of fourteen miles. The plant will contain seven 350-horsepower engines for generating electricity and will be the most completely equipped plant of its kind in that section of Orange County. The equipment will be installed by the Westinghouse Company.

NOBLESVILLE, IND.—Controlling interest in the Noblesville Water and Light Company, held for many years by J. W. Smith and George S. Christian, has been sold to L. N. Joseph and his associates, including forty business men of this city. The transaction involved $55,000. Officers of the new company are: President, A. D. Booth; vice-president, L. N. Joseph; secretary, James Thom; treasurer, J. F. Haines.

REDFIELD, S. D.—The city council is about to let contracts for new boilers for the municipal electric light plant. This plant was taken over by the city from private parties ten years ago, and has been a great success under municipal ownership. The city high-school building has been heated by the exhaust steam from the light plant, and the experiment was so satisfactory that the city will furnish heat to a row of business blocks.

LOCKPORT, N. Y.—A mortgage for $3,500,000 was recently made by the Hydraulic Power Company of Niagara Falls in favor of the Commonwealth Trust Company of New York. Of this amount $650,000 has been advanced. The Hydraulic Power Company of Niagara Falls is familiarly known as the Schoelkopf Power Company. The mortgage was given to secure funds with which to make additions and improvements to the big power plant.

NEW YORK, N. Y.—The American Power and Light Company, of New York has purchased the hydroelectric plant and distributing system of the Wasco Warehouse Milling Company of Dallas, Ore. The plant consists of a hydroelectric generating station on White River and transmission lines to Dufur and The Dalles, Ore., where the power is used for lighting and miscellaneous purposes, including the operation of the large export flouring mills of the Wasco Warehouse Milling Company, at The Dalles.

BOCA, CAL.—A survey is now being made along the Truckee River in the vicinity of Boca for the construction of a gigantic power plant to cost $750,000. The Truckee River will be tapped above Boca, and a long tunnel through the mountain south of the river will be constructed to carry the water, which will empty back to the river about a mile below Boca, thus insuring over 10,000 horsepower to supply lights and power to Reno and other cities along the Truckee River. E. W. Hopkins, president of the Union Ice Company, is interested in the project.

ALLIANCE, NEB.—At a special meeting of the city council the Alliance Electric Light and Power Company offered its plant to the city for $55,000. According to a clause in the agreement between the city and this company, when the franchise was granted, the city reserved the right to purchase the plant at any time during the month of July, 1910, and in the event of the company refusing to accept the offer made by the city, the matter was to be referred to a board of arbitration. The matter will, therefore, now be referred to this board, whose decision will be final.

MANKATO, MINN.—The Consumers Power Company has secured the electric lighting plant at South St. Paul through H. M. Byllesby & Company of Chicago. The same company will also furnish electricity for West St. Paul. Important among the changes in the South St. Paul plant will be the installation of an emergency connection with the power plant of the Byllesby Company on the St. Croix River. Stillwater already receives service from this plant. Transmission to South St. Paul will be made possible by a direct line to be constructed from the plant, making available a powerful reserve for both the South St. Paul and West St. Paul lines.

SPOKANE, WASH.—Spokane capital will build a hydroelectric plant at Three Forks, Gallatin County, Mont., to furnish water, electric light, power and heat. It is estimated that the plant will cost in the neighborhood of $200,000. It is proposed to take the water from the Madison River and put it in a reservoir by gravity. The reservoir will be fifty-five feet above the level of Three Forks and about three-fourths of a mile from that place. The first investment will not exceed $50,000. This will build the water plant and pay for the construction of the electric light plant. Later the system will be increased to include heat and power for Three Forks and vicinity.

PHILADELPHIA, PA.—Work on the new lighting system on Market and Arch streets, west from City Hall to Twenty-third Street, is being pushed rapidly forward, and present expectations are that the system will be completed and the lights turned on by September 15. The general scheme for the improved electric lighting of the center of the city embraces similar improved illumination around Independence Hall and Independence Square, embracing in this detail of the plan Sixth and Fifth streets between Walnut and Chestnut streets. There is included in the new $8,000,000 loan an item of $60,000 for this work and for the renovation of Congress Hall.

ELECTRIC RAILWAYS.

(Special Correspondence.)

DULUTH, MINN.—The Duluth Street Railway Company will spend about $2,500,000 in improving its system. P.

GREENVILLE, TEX.—S. A. Price, of Dayton, O., and others, have been granted an electric street-railway franchise. P.

HAMMONDSPORT, N. Y.—It is reported that work on the Hornell-Branchport electric line will be started inside of a month.

STOCKTON, CAL.—Ground has been broken on the Stockton Modesto electric interurban road near French Camp, south of Stockton. A.

EAST GRAND FORKS, MINN.—The council has granted a fifty-year franchise for a street car system to the Grand Forks Street Railway Company. C.

IOWA CITY, IOWA.—The Iowa City, Ottumwa and Southwestern Electric Railway Company has been incorporated to build an electric line to Ottumwa. C.

SAN MARCOS, TEX.—A franchise for a street-railway system was secured some time ago and the lines have now been surveyed. It is thought that the line will be in operation by January.

MADISON, WIS.—Subscriptions for $60,000 are being solicited by the Chicago and Wisconsin Valley Railroad Company to build an electric line around Lake Monona to cater to the summer resort business. C.

POMONA, CAL.—W. G. Kerckghoff, vice-president of the Pacific Electric Railway, announces that his company will this month begin construction work on the line to extend out East Fifth Street. A.

PIERRE, S. D.—The South Dakota Interurban Railway Company has increased its capital stock from $1,000,000 to $2,000,000 and will extend the western terminal of the road from Bijou Hills to Chamberlain. C.

PARIS, ILL.—Franchises for a line through Kansas, Ashmore and Charleston have been secured by the Central Illinois Traction Company, which operates the interurban line between Mattoon and Charleston. Z.

CHATHAM, ILL.—The village board has granted the Springfield, Peoria & St. Louis Interurban Railway Company a franchise for a new right of way through the village. A new substation will be built at Chatham. Z.

FORT WAYNE, IND.—Estimates which have been made in the electric line between Fort Wayne and Warsaw place the probable cost of construction at over one million dollars. The line is to be a little over forty miles in length.

CLEBURNE, TEX.—It is stated by Daniel Hewitt, who is promoting a proposition to construct a street railway system in this city, that he will be prepared to build the system in a short time. A powerhouse will also be erected. D.

CHAMPAIGN, ILL.—A meeting of the stockholders of the St. Louis, Springfield & Peoria Railroad will take place in Champaign September 2, for the purpose of voting on a proposition to increase the capital stock of the railroad from $5,000,000 to $5,050,000. Z.

BARTLESVILLE, OKLA.—At the annual meeting of the Bartlesville Interurban Railway Company it was decided that the company shall enter into the lighting business here. The company has heretofore been kept out of the field by the old Bartlesville Light and Water Company.

GILROY, CAL.—As soon as the Peninsula Electric Railway Company completes its line between San Jose and San Francisco, Cal., an electric interurban-car system will be installed between here and San Jose. Construction work is expected to commence about the first of next year. A.

SAN ANTONIO, TEX.—The San Antonio Traction Company is preparing to extend its South Flores car line from its present terminus to the suburb of Harlandale, a distance of one and one-half miles. Manager W. B. Tuttle of the traction company states that work will begin in a short time. D.

SAN FRANCISCO, CAL.—A franchise has been asked for an electric street railway from the intersection of Parnassus Avenue to Judah Street, to Ninth Avenue, to Pacheco Street. Bids have been ordered advertised and Monday, September 12, set for opening the bids and awarding the franchise. A.

PINE BLUFF, ARK.—Improvements to the extent of $350,000 are being planned by the Citizens Light and Transit Company of this city. Money has already been secured for the work. The company will, with this money, purchase several new cars, extend several of its lines and make other needed improvements.

NORTH TONAWANDA, N. Y.—The Frontier Electric Railway Company, through its vice-president, has made application to the Tonawanda Common Council for a right of way through the city with its proposed fast service trolley line between Buffalo and Niagara Falls. The matter was referred for investigation.

COLUMBUS, IND.—A new interurban line between Nashville and Fruitdale, Brown County, and construction work is to begin within the next thirty days, and another interurban line is being promoted from Brownstown to connect with the new line. It is the intention to complete the new road by the first of next April at a cost not to exceed $10,000.

WAUKEGAN, ILL.—Construction work has been started on the electric line between Palatine, Lake Zurich and Wauconda, and it is expected that the road will be in operation before winter. Officers of the new company are: Charles Patten, president; R. D. Wynn, vice-president; Theo. Durst, treasurer, and J. K. Orvis, secretary.

ROSWELL, N. M.—The Bernendo Irrigated Farms Company, which owns the Roswell electric light plant, will this year install an electric street car system in this city. The proposed route is out to the Bernendo Irrigated Farms, Roswell Country Club, Lea Lake Club, Hagerman orchards and farms and the South Springs, five miles south of Roswell. A.

BOZEMAN, MONT.—Construction work for the lines and buildings of the Gallatin Valley Railway is being pushed now very rapidly and much will be finished in the next few months. Track laying has already been begun on the Three Forks end of the line and will soon be started at the Hot Springs. It is expected that the track will be in place by September 10.

ALAMEDA, CAL.—F. W. Hoover of the Southern Pacific Railroad Company announces that the electric service of his company will start operations this November. Mr. Hoover states that all the pole lines, except the High Street connecting loop, are in place and that a delay in finishing the transmission power house has caused the opening of the service to be put off until late in the fall. A.

SCOTTSBURG, IND.—In order to hold franchise rights two men have begun work to build a traction line from this city to Madison, to be known as the Cincinnati, Madison and Western Traction Company. The people regard this action favorable to the building of the road by the promoters. The proposed road will cost about $750,000. Substantial subsidies have been voted in aid of the road if terms are complied with. S.

COVINA, CAL.—For the purpose of beginning the work on the extension of the Pacific Electric Railway from Covina to San Dimas and Pomona, a large amount of material for construction has arrived in Covina. More ties and rails are said to be on the way, while a gang of workmen is doing the preliminary work. The line will connect Los Angeles eventually with all the important towns east of Covina, making of Covina a central railroad point in the network of Huntington lines.

TORREON, MEX.—The street car concession, owned by the Chinese capitalists, Cia Bancaria y de Tranvias Wah Yick, which has been an object of speculation for some time, has been given under option to a party of local capitalists headed by Manual Campos, who plan to organize a stock company to develop and operate the street car system. The plan is to organize a company with a capital stock of $200,000, to be divided into 10,000 shares at a par value of $20 a share.

MUSKOGEE, OKLA.—The Rapid Transit Interurban Company has secured from the city of Tecumseh a franchise and from the county commissioners of Pottawatomie County permission to cross all public roads and highways; therefore the preliminary work of constructing the line from Tecumseh to Sulphur will be commenced at once and will be pushed. The Rapid Transit Interurban Company was incorporated under the laws of the Territory of Oklahoma, with a capital stock of $2,500,000, to build an electric interurban railroad from Muskogee to Chickasha, and from Guthrie to Sulphur, crossing at Tecumseh.

SALEM, ORE.—The Coos Bay Traction Company has filed articles of incorporation with the secretary of state. The capitalization of the company is given at $1,000,000, and the incorporators are: Fred Hollister, of North Bend; Geo. M. Perrine, of San Francisco; George A. Averill, of Marshfield; N. B. Campbell, of San Francisco, and R. P. Farding, of the same city. The object of the incorporation is to construct and operate a line of railroad which will have its beginning at Coos Bay, and which may be extended to some transcontinental line in the state of Oregon. Incident to this main object, the company will also produce and distribute electricity for the illumination of villages and cities, and operation of railway lines, and also manufacture ice.

STILLWATER, OKLA.—The Oklahoma Public Service and Interurban Lines, which has recently organized with a capital stock of $1,000,000, is promoting one of the most extensive systems of electric interurban lines in Oklahoma, with Stillwater as the proposed center of operations. The proposed transit system involves the construction of a line of electric railway from here to Morrison, fourteen miles; from Stillwater to Perkins, ten miles; from Stillwater to Glencoe, Merrimac, Jennings and Sapulpa, seventy-nine miles, and from Stillwater to Coyle, Langston and Guthrie, forty-five miles, a total of 148 miles. It is estimated that it will cost about $6,000,000 to construct and equip the proposed system. The directors of the company are Harry G. Lytle, of Brooklyn, N. Y.; H. L. Drullard, George W. Tucker, Jr., and L. G. Lampke, of New York; Claud Powell, R. A. Sturgeon and Louis James Lampke, of Stillwater. It is stated that the company has ample financial backing to carry out its extensive plans and that the work of construction will be started as soon as the necessary franchises and right of way can be secured and other preliminary details arranged. D.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

CANTON, KAN.—The Canton Telephone Company recently installed a new 200-drop switchboard in its central office.

HELENA, MONT.—The Billings Automatic Telephone Company has been incorporated with a capital stock of $500,000, and will operate in Billings, Mont. P.

McCONNELLSVILLE, O.—The Citizens Telephone Company has been incorporated with a capital of $20,000. F. J. Bailey, James Donahue, A. J. Davis and M. D. Davis are the incorporators.

SELMA, ALA.—Rural telephone lines are being built in practically every section of Dallas (Selma) County, connecting with the Southern Bell Telephone and Telegraph Company's main office at Atlanta, Ga.

ADRIAN, MICH.—The Lenawee County Telephone Company, which is a merger of the Bell and Independent lines in Adrian, has just been organized. Officers of the new company are: President, W. O. Hunt; vice-presidents, W. O. Trafford and Charles G. Hart; treasurer, B. E. Tobias.

DETROIT, MICH.—The new Bell telephone exchange building for Highland Park, at Glendale and Second avenues, is now up to the roof line and soon will be all inclosed. Installation of equipment will follow, and it is expected that the new exchange will be ready for operation by January 1.

HIBBING, MINN.—The Mesaba Telephone Company recently installed a telephone exchange in the Oliver Iron Mining Company offices, including 100 telephones, connecting with the various offices and mines. An exchange of twenty-five telephones will be installed at the Monroe mine and connections.

BUTTE, MONT.—The Montana Independent Telephone Company announces that it has completed a new metallic-circuit long-distance line between the new hotel at Boulder Hot Springs and the independent system. It is now possible for those at the hotel to communicate with Butte, Helena, Great Falls, Anaconda and other cities in the state.

MOSIDA, UTAH.—The Mosida Telephone Company has filed articles of incorporation with the secretary of state. The company takes over the telephone line between Lehi and Mosida in payment of the capital stock of $2,500, divided into 250 shares of $10 each. The officers are: L. B. Curtis, W. F. R. Mills, H. C. Allen, A. J. Stark and Roy P. Curtis.

QUINCY, CAL.—The Pacific States Telegraph and Telephone Company will soon have a line out of Quincy and Plumas County. The company has practically decided to string wires on the poles of the Western Union Telegraph Company along the line of the Western Pacific in the North Fork Canyon and along the East Branch River and Spanish Creek from Oroville to Quincy.

ALBANY, N. Y.—A certificate of incorporation has been filed with the Secretary of State by the Wedgewood Telephone Company, which will operate in Schuyler County. The following places are to be connected: The towns of Dix, Moreland Central, Beaver Dams, Wedgewood Station, Townsend Corners, and Watkins Glen. The capital stock is $1,000 and the directors are O. F. Corwin, W. T. Wakemen, H. W. Phelps, Ray W. Cowin, John Callahan and F. W. Church, all of Watkins, N. Y. T.

SAN FRANCISCO, CAL.—The Home Telephone companies of the bay cities have merged their interests into the Bay Cities Home Telephone Company, according to a recent announcement. The mortgages held by the Union Trust Company on the properties of the local Home company and by the Mercantile Trust Company on those of the Alameda company have been taken up and the Anglo-California Trust Company has assumed the trusteeship of the new corporation and will underwrite a $20,000,000 bond issue retiring the others.

NASHVILLE, ILL.—The Lafferty Telephone Company, organized by C. W. Lafferty, former manager of the Central Union Exchange at Ashley, proposes to build an independent county system with full service over the county. It is said connections with the Kinloch have been arranged. The Central Union Company has induced the Washington County Mutual Telephone Company to connect with their lines for sixty days, after trying for several years to put through the deal. The Central Union Company is also about to rebuild the outside plant in Nashville.

SAN ANTONIO, TEXAS.—M. Bernays Johnson, of St. Louis, Mo., inventor of a wireless-telephone apparatus, is here arranging to install the new system. He says that it will be extended to cover every part of the city. Mr. Johnson is only seventeen years old. He is the foster son of Charles P. Johnson, of St. Louis. According to the statement of the young inventor he selected San Antonio as the location for installing the new system because the climatic and other conditions that exist here are ideal for a thorough test of the apparatus. He has strong financial backing in this new field of operations and will install his wireless-telephone system all over the country, he says. He makes the claim that his system is the only wireless one in which the telephones may be operated simultaneously without interfering with one another. Long-distance stations will be established by Mr. Johnson when he has the San Antonio system installed and in good working order. He expects to have the one here finished by September 15.

ELECTRICAL SECURITIES.

Although the week was a light one as far as trading was concerned, the market as a whole showed a good gain in prices. The volume of business was small, being only slightly more than one-third of that of the corresponding week of a year ago. The fact that the market was awaiting the receipt of the government crop report held the interests on both sides in waiting. Money is becoming easier. New York banks have substantially increased their reserve. Call money continues cheap and plentiful, and time money, particularly for short maturities, is easier. The west also reports improvement and sees no reason for fearing any stringency later.

It is pointed out that by the increase in the holdings of securities of subsidiary companies Massachusetts Electric now can meet its full four per cent dividends on its preferred stock through dividends of four and one-half per cent on the stocks of the subsidiaries, whereas when the company was organized dividends of six per cent on the subsidiary stocks were necessary to meet the requirements of four per cent on Massachusetts Electric preferred.

Concord, Mass., has awarded $20,000 four per cent municipal light bonds dated August 1, 1910, maturing 1940, to Estabrook & Co., at 102.659.

DIVIDENDS.

The Niles-Bement-Pond Company has declared the regular quarterly dividends of 1.5 per cent on the common and preferred. Preferred dividend is payable August 15. Books close August 6 and reopen August 16. Common dividend is payable September 20. Books close September 10 and reopen September 21.

The Columbus Railway Company has declared a regular quarterly dividend of one and one-fourth per cent on common stock, payable September 1 as registered August 15. Books close August 15 and August 16.

American Railways Company has declared a regular quarterly dividend of 1½ per cent, payable September 15, to stock of record August 26. Books close August 26; reopen September 6.

Philadelphia Electric Company declared regular quarterly dividend of one and one-half per cent, payable September 15 to stock of record August 19. Books do not close.

The books of the Scranton Railway preferred stock five per cent gold trust certificates will be closed August 24, and will be opened September 1.

El Paso Electric Company declared a dividend of $2 a share on the common, payable September 15 to stock of record September 1.

CLOSING BID PRICE FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.

	August 15.	August 8.
Allis-Chalmers common	8	8½
Allis-Chalmers preferred	30	27
Amalgamated Copper	66½	63⅜
American Tel. & Cable	*80	*80
American Tel. & Tel.	133¾	131⅜
Brooklyn Rapid Transit	77	75⅜
General Electric	143	141
Interborough-Metropolitan common	17	16¾
Interborough-Metropolitan preferred	47	46½
Kings County Electric	124	*124
Mackay Companies (Postal Telegraph and Cables) common	85	82½
Mackay Companies (Postal Telegraph and Cables) preferred	73	71
Manhattan Elevated	128	129
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	*103
U. S. Steel common	71½	68½
U. S. Steel preferred	116⅜	114⅝
Western Union	63½	63
Westinghouse common	59	58
Westinghouse preferred	*125	*125

*Last price quoted.

BOSTON.

	August 15.	August 8.
American Tel. & Tel.	133¾	132
Edison Elec. Illuminating	256	*255
General Electric	143	139
Massachusetts Electric common	16	15¼
Massachusetts Electric preferred	81½	....
New England Telephone	129	132
Western Tel. & Tel common	15	*15
Western Tel. & Tel. preferred	84	*85

PHILADELPHIA.

	August 15.	August 8.
American Railways	43	42
Electric Company of America	11	11¼
Electric Storage Battery common	49½	47⅜
Electric Storage Battery preferred	49½	*49
Philadelphia Electric	15½	14¾
Philadelphia Rapid Transit	20	18⅜
Philadelphia Traction	82⅝	82½
Union Traction	45½	43⅜

CHICAGO.

	August 15.	August 8.
Chicago Railways, Series 1	70	65
Chicago Railways, Series 2	16	*15
Chicago Subway	5¼	2¼
Chicago Telephone	117	115½
Commonwealth Edison	111	110¾
Metropolitan Elevated common	19	18
Metropolitan Elevated preferred	61	60
National Carbon common	117½	118
National Carbon preferred	117	118¼

PERSONAL MENTION.

THEODORE T. FITCH, of the Electrical Testing Section of the Bureau of Standards, has returned from a trip in the West.

WILLIAM T. BAWDEN, formerly of the State Normal School, has been appointed assistant professor of engineering in the University of Illinois.

J. N. C. GRAHAM, of the Plant Department of the New York Telephone Company, has just returned from a vacation in the Adirondack Mountains.

JAMES A. LORD, of the U. S. Census Office, has been appointed statistician of the newly organized Bureau of Railway Economics at Washington.

H. A. FOSTER, consulting engineer, has closed his offices in Detroit, Mich., and Pittsburg, Pa., and will hereafter be located at Los Angeles, Cal. His office address will be 521 San Fernando Building.

H. M. HIRSCHBERG, president of the Excello Arc Lamp Company, who sailed abroad in June, has returned home after his annual visit to the lamp works, brimming over with enthusiasm, as usual, over the Excello arc lamp.

W. M. LALOR has resigned as manager, Railway Department, The United States Light and Heating Company, to accept the position of sales engineer with the Electrical Department of The Gould Coupler Company, with offices in Chicago.

FRANK L. PERRY, who has been busily engaged for the last few weeks upon special work in the south, has blossomed forth again as the author of an excellent study of the new Wright aeroplane in the *Baltimore Sun* of July 17.

EDWARD F. ATKINS, the newly elected president of the Westinghouse Electric & Manufacturing Company, was born in Boston in 1850. He received his education in the private schools of the city, and in 1903 Harvard University conferred upon him the honorary degree of A. M. He has been prominently identified for years with Boston's business and financial interests, but is best known as an importer and refiner of Cuban sugars. He served as president of the Bay State Refinery Company for eleven years—1878 to 1889—and as the present head of the firm of E. F. Atkins & Company he does an enormous business. He served as vice-president and director of the Union Pacific system from 1889 to 1895, when the Gould-Ames interests controlled its affairs. He is now president of the Aetna Mills, Soledad Sugar Company, Cuba; Trinidad Sugar Company, Cuba; Boston Wharf Company; and director in the American Trust Company, Eliot National Bank, American Sugar Refining Company, West End Street Railway, Guarantee Company of North America and others. He has served as a director of the Westinghouse concern ever since its reorganization in 1908 and has had an important hand in shaping up its affairs in the policy which has re-established the company's financial standing on a strong basis.

EDWARD F. ATKINS.

HOWARD L. BRONSON, assistant professor of physics in McGill University, has been appointed to the chair of physics in Dalhousie University, Halifax, vacated by the resignation of Prof. A. S. Mackenzie to accept a chair in the Stevens Institute of Technology.

JOHN J. CARTY, chief engineer of the American Telephone and Telegraph Company, accompanied by his wife and son, sailed on Wednesday of last week for Paris, where Mr. Carty will attend the international meeting of telephone engineers to be held in that city. Mr. Carty will be absent about six weeks.

CHARLES A. DRESSER has resigned from Kohler Brothers, with whom he has been associated for seventeen years, to take a position with Buckie Printers' Rollers Company, 396 South Clark Street, Chicago, and expects to devote his time to the newspaper business, with which he has been closely associated for the past ten years.

BELA GATI, a well-known electrical engineer and telephone expert, of Budapest, Austria-Hungary, intends to make a journey through the United States, from coast to coast, in or about October of this year. Mr. Gati will present a paper at the second international conference of telephone and telegraph engineers, which is to be held in Paris, France, September 4-11 next.

G. H. BURR, superintendent of the lighting plant at Conway, Ark., recently tendered his resignation to the City Council. Mr. Burr has accepted the position of supervising engineer for an $80,000 drainage district in Conway County and this, in connection with his duties as a member of the Hendrix College faculty, made it impracticable for him to continue in charge of the plant.

ALFRED E. BRADDELL, who has been attached to the Chicago office of the Sprague Electric Company for the last two years, has been transferred to the general office of the company, at 527 West Thirty-fourth Street, New York City. Mr. Braddell has been connected with the Sprague company since December, 1905, at which time he went to the Philadelphia office. With his headquarters now in New York, and with his wide acquaintance and thorough knowledge of conduit materials, he will be able to carry on a larger work for the company.

OBITUARY.

J. B. WATT, aged sixty-two years, died at his home in Nashville, Tenn., August 4. Mr. Watt was one of the oldest telegraphers in the country, having served in that capacity for forty-five years.

GEORGE FLETT, managing director of the well-known firm of electrical engineers and contractors, Merr-Dick-Ven & Company, of London and Preston, England, was recently killed in a motor car accident in Birmingham. At the inquest it was stated that the driver of the car, in avoiding a child, turned the car and applied the brakes so suddenly that the car overturned and unfortunately fell upon Mr. Flett, who was on the driver's seat, crushing him. G.

JOSEPH I. IRWIN, one of the oldest and best known traction men in Indiana, died recently. Mr. Irwin built with his own money the first interurban line in Indiana, this line connecting Indianapolis with South Port, twelve miles distant. Later he organized the Indianapolis, Columbus and Southern Traction Company and extended the line to Columbus and Seymour. It is said that all the stock of this company is held by the members of the Irwin family. Mr. Irwin was also a successful banker and large real estate holder. He was born in Bartholomew County near Columbus and was within a few days of eighty-six years of age.

ALEXANDER HENDERSON, one of the most popular men in the electrical industry, died on Thursday, August 11, at his farm home in New Hampshire. The funeral was held on Monday, August 15, at West Moreland Station, N. H., at 1 o'clock. Mr. Henderson had a long and varied career in the electrical industry and has been a very prominent figure at state and national gatherings of electrical men for the past twenty years. He joined the American Institute of Electrical Engineers on November 30, 1897, when he was chief inspector of the fire department of New York City. Later on he was prominently connected as sales manager with the Sprague Electric Company, of New York City, and in 1907 he was appointed electrician of the American Circular Loom Company, making his headquarters at 45 Milk Street, Boston. This position he occupied at the time of his death.

LEGAL NOTES.

RISK ASSUMED IN WORKING ON OR NEAR ELECTRIC CABLES.—Where an employee was set to work stripping the lead covering from certain electric wire cables, the supreme judicial court of Massachusetts says that there was no duty incumbent upon the company to warn him of the general danger of working upon or near to heavily charged electric wire cables, because that was one of the obvious risks of his employment.—Grebenstein vs. Stone & Webster Engineering Corporation, 91 N. E., 411.

WHAT THE LAW REQUIRES IN PROVIDING ELECTRICAL APPLIANCES.—The court of appeals of Kentucky says that it has frequently announced that all that the employer is required to do is to furnish reasonably safe places and appliances, and that this degree of care does not demand that he should furnish the very latest and best improvements. It will be sufficient if those furnished are in general use and generally regarded as reasonably safe. There does not seem to be any reason why this rule should not be applied to electrical appliances. All that the employer should be required to do in any kind of business is to furnish appliances that are in general use and generally regarded as being properly and safely constructed. The fact that electricity is a dangerous and deadly agency should not be allowed to alter this rule. It is an agency in general and practical use, and when a person who desires to install an electric plant procures appliances and fixtures that are constructed on safe and approved plans, and maintains them in good repair and in the same condition as when he installs them, he has discharged as far as he should be required to do his duty in this respect towards all persons, whether employees or not. It is not possible to so construct appliances used with electricity that they will not be dangerous to persons who fail to exercise ordinary care for their own safety and protection. To lay down a rule that the employer must have his appliances so constructed that a careless or inattentive operator would not be in peril would be to impose upon him conditions that could not in any state of case be complied with. No machinery operated by steam or electricity is safe in the sense that an operator cannot be injured by it. But if an appliance or fixture used in connection with electricity is for any reason permitted to become defective or unsafe, this court would apply the rule imposing upon the employer the utmost degree of care to keep the place and appliance safe. It would hold that this rule should be applied as between employer and employee, as it is just as important that those who are employed about electrical machinery should have the same measure of protection as any other person who may come into contact with it.—Lancaster's Administratrix vs. Central City Light & Power Company, 125 S. W., 739.

PROPOSALS.

POST OFFICE, WAYCROSS, GA.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until September 15 for the construction (including plumbing, gas piping, heating apparatus, and electric conduits and wiring) of the United States post office at Waycross, Ga., in accordance with drawings and specifications, copies of which may be had from the custodian of site at Waycross, Ga., or at the Supervising Architect's office.

POST OFFICE, EASTON, PA.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until September 20, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States post office at Easton, Pa., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Easton, Pa., or at the Supervising Architect's office.

POST OFFICE, CLINTON, MO.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until September 22 for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States post office at Clinton, Mo., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Clinton, Mo., or at the Supervising Architect's office.

POST OFFICE, HARRIMAN, TENN.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until September 16 for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States post office at Harriman, Tenn., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Harriman, Tenn., or at the Supervising Architect's office.

NEW INCORPORATIONS.

BEACH, N. D.—The Beach Electric Company has been incorporated with a capital stock of $50,000. The incorporators are: James G. Robertson, Alexander R. Robertson, both of St. Paul, Minn., and George S. Chrysler, Beach, N. D.

INDIANAPOLIS, IND.—Articles of incorporation have been filed by the Chapin Manufacturing Company, capitalized at $20,000. The company proposes to manufacture carburetors, automobile and electrical supplies. Frank O. Chapin, George F. Quick and G. J. Derthlick are directors.

HUNTINGTON, W. VA.—The C. and W. Electric Company of this city has been incorporated to do a general electrical-supply business. The capital stock is $10,000 and the incorporators are B. P. Connell, C. L. Walker, W. O. Reckard, W. C. Mellar and F. E. Walker, all of Huntington.

NATIONAL ELECTRIC ASSOCIATION.—Under this name a company has been incorporated in Boston, for founding an electrical and mechanical school. The capital of the company is $50,000, and the incorporators are: William B. Clayton, James W. Craig, Joseph P. Catlin and H. C. Attwill.

ROCHESTER, N. Y.—The Rochester Trolley Guard and Fender Company of Rochester, has been incorporated with the secretary of state with a capital of $50,000. The concern will manufacture all kinds of trolley guards and fenders and will deal in trolley and railway supplies.

UTICA, N. Y.—Articles of incorporation have been filed by the Electric Horn and Specialty Company. The concern has a capital stock of $5,000 and the principal office will be at Utica. The directors are Michael J. Carroll and William F. Carroll, of Utica, and Alfred Murray and D. A. Lapham, of Ilion, N. Y. T.

NEW YORK, N. Y.—The Electric Daylight Company of New York City, to manufacture electric lamps and electrical apparatus, has been incorporated in the office of the secretary of state with a capital of $100,000. The directors are William H. Gardiner and Alvah W. Young of No. 74 Cortland Street, and Benjamin R. C. Low, No. 30 Broad Street, New York City.

GARY, IND.—The Indiana Electric Company is the name of a new corporation organized here with a capitalization of $50,000. The object of the corporation is to do a general engineering and electrical construction business; also to manufacture and deal in electrical supplies and equipment of all kinds. The directors are: Fred L. Talcott, D. H. Gardner and D. A. Wellinghoff. S.

NEW YORK, N. Y.—The Electric Utilities Company of New York City, to do general electrical work and manufacture dynamos and electrical motors, has filed articles of incorporation with the Secretary of State. The directors are Nathan Cohen of No. 27 West Twenty-seventh Street; Gertrude Cohen of No. 269 West One Hundred and Fifty-third Street and Norman S. Riesenfeld of No. 141 Broadway, New York City. F.

NEW YORK, N. Y.—The Main Electric Company has been incorporated to do all kinds of electrical work, especially on electrical dynamos and machinery. The capital is $50,000 and the directors are Samuel White, of No. 214 East One Hundred and Fourteenth Street; Eugene Braun, of No. 300 West Thirty-eighth Street; Henry Hulenekes, of No. 523 West One Hundred and Sixteenth Street, and Oscar Bissmark of No. 300 West Thirty-eighth Street. F.

INDUSTRIAL ITEMS.

THE McROY CLAY WORKS, The Rookery, Chicago, has sent out its August calendar and blotter advertising McRay conduits.

THE SAFETY INSULATED WIRE AND CABLE COMPANY, New York, N. Y., has been awarded a contract for laying the underground conduits in New Britain, Conn.

THE FAIRMOUNT ELECTRIC AND MANUFACTURING COMPANY, Philadelphia, Pa., has sent to the trade a loose leaf catalog of electrical specialties. Prices and discounts are given and the catalogue is well illustrated.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, O., is mailing folders describing its type "F" steel-frame, direct-current motor. The folder gives only a few short remarks, as a complete description is contained in the company's bulletin No. 391.

THE GARWOOD ELECTRIC COMPANY, New York, N. Y., reports having taken a number of orders recently. Among others there was one for two 100-kilowatt and one seventy-five-kilowatt engine-type generators for the Germania Life Insurance Building, New York City. A number of slow-speed motors have been ordered for ventilating in various buildings.

THE F. BISSELL COMPANY, Toledo, O., has mailed to the trade bulletin No. 33, on direct-current "Security" switchboards. The switchboards which are described cover the usual requirements of 125 and 250-volt direct-current service for central stations and isolated plants. Aside from switchboards, the bulletin lists a line of meters, instruments, circuit breakers, switches, etc.

THE ELECTRO-MECHANICAL ENGINEERING COMPANY, Chicago, Ill., which is now engaged in the preparation of plans and specifications for the remodeling and enlargement of the electric-lighting and water-works plant at Bremen, Ind., reports a busy and prosperous season. The company has devoted its attention to consulting and designing engineering in making reports on plants, etc., but recently has branched out and entered the contracting field.

THE PACIFIC ELECTRIC HEATING COMPANY, Ontario, Cal., has devoted the August number of its publication, *Hot Points*, to a discussion of the "Bill Raisers." This term is applied to those circumstances which tend to increase current consumption as autumn days grow shorter. "Bill Raisers," the booklet states, are somewhat misunderstood by the public. The remedy lies in education and the Pacific Electric Heating Company is joining in a campaign to gain this end.

C. W. HUNT COMPANY, New York, N. Y., has issued catalog No. 102 describing the various types of machinery which it builds. The catalog is well illustrated throughout and shows not only the products of the company, but numerous applications of them. A notable feature of the publication is that superlative adjectives are vigorously excluded and that materials are designated by their correct engineering terms. The booklet is accurate in an engineering as well as a business sense.

H. T. PAISTE COMPANY, Philadelphia, Pa., has published a condensed catalog of electric-light-wiring material manufactured by them. As the catalog is largely for reference purposes a great deal of descriptive matter on the better-known material has been omitted. Almost all of the material listed has been approved by the National Board of Fire Underwriters, but inasmuch as there are exceptions these have been marked. This is of particular value to the wireman in selecting fittings. The catalog is will illustrated throughout and contains a complete price list.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is building for the Montreal substation of the Canadian Light and Power Company (J. G. White & Company, Engineers) a switchboard consisting of a nine-panel benchboard, together with auxiliary panels and complete high and low-tension switching apparatus. The current will be received at 48,000 volts, stepping down to 13,200. The capacity of the substation when put in operation will be 16,000 kilowatts, with a steam auxiliary of 4000 kilowatts. The ultimate capacity is 48,000 kilowatts, with a steam auxiliary of 8,000 kilowatts.

THE GENERAL VEHICLE COMPANY, Long Island City, N. Y., has issued its August number of *Elec-Tricks*. One of the interesting articles in this booklet has to do with the extensive use of electric automobiles and shows some figures gathered from General Vehicle customers. These figures show that the field of usefulness of the electric is much wider than is generally supposed. In all thirty-two different kinds of business concerns are using them in preference to horse-drawn vehicles and many firms have anywhere from one to sixteen electric vehicles. Some have ten or fifteen and a few twenty-five or over.

DATES AHEAD.

Pacific Coast Electric Vehicle Association. Next meeting, San Francisco, week of August 22.

League of American Municipalities. Annual convention, St. Paul, Minn., August 23-26.

Northwest Electric Light and Power Association. Annual convention on board the steamship *Queen*, leaving Seattle, Wash., August 26 and returning August 29.

Telephone and Telegraph Engineers' Second International Conference. Paris, France, September 4-11.

International Association of Municipal Electricians. Annual convention, Rochester, N. Y., September 6-9.

Old Time Telegraphers' and Historical Association and the Society of the United States Military Telegraph Corps. Twenty-ninth annual reunion, Chicago, Ill., September 8-10.

New England Section, National Electric Light Association. Fall convention, Pleasant Point, New London, Conn., September 13 and 14.

Pennsylvania Electric Association Convention. Glen Summit Springs, Pa., September 14-16.

Pacific Coast Electrical Exposition. San Francisco, Cal., September 17 to September 24, 1910.

Colorado Electric Light, Power and Railway Association. Next convention, Glenwood Springs, Colo., September 21-22-23.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Kansas City, Kan., September 27 and 28.

Denver Electric Show. Colorado Electric Club, Denver, Colo., October 8-15.

American Street and Interurban Railway Association. Annual convention, Atlantic City, N. J., October 10-14.

American Society of Municipal Improvements. Annual convention, Erie, Pa., October 11-14.

Railway Signal Association. Annual meeting, Richmond, Va., October 11.

American Electrochemical Society. Eighteenth general meeting, Chicago, Ill., October 13-15.

American Association of Electric Motor Manufacturers. Semi-annual meeting, Chicago, November 14-16.

Alabama Light and Traction Association. Next meeting, Anniston, Ala., November 21-23.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) August 9, 1910.

966,421. PORTABLE ELECTRICAL MEASURING INSTRUMENT. Walter E. Beede, New York, N. Y., assignor to American Ever Ready Company. Filed Dec. 21, 1909. A pocket ammeter contains within a watchcase a flattened solenoid into which a curved iron armature carrying the pointer is adapted to swing against the force of a coiled spring.

966,456. CONTROLLING MEANS FOR ELECTRIC CIRCUITS. Julius K. Lux, St. Louis, Mo. Filed Apr. 3, 1906. One contact of this switch is mounted loosely so as to rock transversely and longitudinally. Contacts on the rotary element engage opposite faces of the first contact.

966,457. OPERATING MEANS FOR CIRCUIT-CONTROLLING DEVICES. Julius K. Lux, Washington, D. C. Filed Aug. 25, 1906. In an operating means for a rotary snap switch there are co-axial positioning members having coacting inclined faces for positioning an indicating means.

966,467. TELEPHONE-RECEIVER. Katherine Nichols and Isaac W. Nichols, Newark, N. J. Filed Sept. 5, 1908. To the chamber about the diaphragm there is connected a passage to which is secured a flexible tube carrying a second earpiece at its end.

966,475. SPACE TELEGRAPHY. Chester R. Saffell, United States Navy, assignor to John Firth, New York, N. Y. Filed Aug. 12, 1909. The transmitting system comprises an oscillation circuit, an alternating-current generator, a motor driving the generator, a transmitting key and means controlled by the key for decreasing the energization of the motor field.

966,490. TELEGRAPH REPEATER. Robert H. Tudor, Corinth, Miss., assignor of one-half to Ernest F. Waits, Corinth, Miss. Filed May 2, 1910. Consists of main-line relays and resistances includable in series with each relay to balance the cutting out of the other relay from the circuit.

966,520. MEANS FOR LIGHTING CHRISTMAS TREES. Eugene J. Bumiller, Chicago, Ill. Filed Jan. 15, 1910. An arrangement for supplying current to the electric lights on a rotating tree consists of two collector rings and brushes.

966,526. SYSTEM OF ELECTRICAL DISTRIBUTION. William H. Clarke, Chicago, Ill. Filed June 15, 1907. A circuit containing multiple lamps is fed from a variable-potential source but maintained at constant potential by means of a variable resistance in series which is adjusted by a sectional solenoid.

966,539. TRANSMITTING APPARATUS. Lee de Forest, New York, N. Y., assignor to The Radio Telephone Company, New York, N. Y. Filed Aug. 24, 1908. Combined with a singing-arc circuit for developing electromagnetic waves is a chimney about the arc and means for maintaining a draft of denatured alcohol through the chimney.

966,553. TIME-RECORDING APPARATUS. William H. Jackson, Palisade, N. J. Filed Aug. 25, 1908. An electrically operated clock for stamping on cards the time of arrival and departure of employees.

966,555. VARIABLE SELF-INDUCTANCE COIL. Joseph Ray Jesse, Birmingham, Ala. Filed Dec. 7, 1909. A primary coil is wound on a core. Over one-half the primary is wound a secondary coil. Sliding contacts on each coil permit adjustment of the active turns in each coil and thereby of the inductance of the set.

966,560. ARC MECHANISM FOR SPACE SIGNALING. Roscoe Kent, New York, N. Y., assignor to The Radio Telephone Company, New York, N. Y. Filed Aug. 24, 1908. Below the arc electrodes is a drip pan. Above and to one side of them is a reservoir with a pipe leading directly over the arc so that a vaporizing liquid may be dropped through the arc.

966,571. METHOD OF MANUFACTURING INCANDESCENT LAMPS. Robert K. Mickey, Emporium, Pa., assignor to Novelty Incandescent Lamp Company, Emporium, Pa. Filed Dec. 14, 1909. A method of sealing a filament-supporting stem in the bulb consists in placing the stem within the neck of the bulb, and then directing a fusing flame blast exteriorly against the neck to fold it around the edge of the flange of the stem both above and below the same.

966,583. INSULATOR-PROTECTING APPARATUS. Lloyd C. Nicholson, Buffalo, N. Y. Filed Sept. 10, 1909. A ring-shaped electrode fits around the neck of a pin insulator but is spaced away from it and connected to the line wire. A grounded second electrode is arranged about the base so that the pair divert the power arc away from the insulator when a flash-over occurs.

966,584. PROTECTING APPARATUS FOR INSULATORS. Lloyd C. Nicholson, Buffalo, N. Y. Filed Sept. 10, 1909. An arrangement similar to the above for suspension-type insulators.

966,623. SOCKET-SUPPORT FOR ELECTRIC LAMPS. William C. Tregoning, Cleveland, Ohio. Filed Mar. 5, 1910. A two-part socket has a conducting piece in the bottom with extensions next to the wall of the socket, etc.

966,626. FIXTURE FOR GAS OR ELECTRIC LIGHTING. Charles E. Ummbach, Chicago, Ill. Filed July 12, 1909. A chain in a pendent fixture has the adjacent ends of adjacent links provided with registering perforations for the gas tube or wires.

966,640. GARMENT-CREASER. Roy K. Aselstine and George W. Langdon, Ottawa, Ontario, Canada. Filed Jan. 17, 1910. A pair of arms joined near their center carry at their outer ends short tubes parallel to each other and normal to the arms. Attached to the tubes are electric heating coils and about these are journaled ironing drums.

966,644. ELECTRIC CABLE. Georg Bartels, Nippes, near Cologne, Germany, assignor to Land und Seekabelwerke Aktiengesellschaft, Nippes, near Cologne, Germany. Filed Aug. 26, 1908. A submarine power cable has two armors insulated from each other and connected to a low-potential source. On damage to the cable the two armors become short-circuited and a device in the low-potential circuit cuts out the power supply and simultaneously grounds all conducting parts of the cable.

966,655. ELECTRICAL PROTECTIVE APPARATUS. Frank B. Cook, Chicago, Ill. Filed July 15, 1909. The device consists of a combined lightning arrester, electrothermal protector and inclosed fuse for mounting on telephone distributing frames.

966,681. SERIES LAMP-RECEPTACLE. Charles D. Gervin, New York, N. Y., assignor to John H. Dale, New York, N. Y. Filed Feb. 20, 1909. In a series lamp cluster each socket shell has a tongue stamped outward into engagement with the center contact of the next socket.

966,690. ELECTRICAL GAS-LIGHTING DEVICE. Edward R. Joseph, Elkhart, Ind. Filed Dec. 18, 1909. Covers the manner of attaching the device to a gas burner and the method of securing the wires to it.

966,694. ALARM ATTACHMENT FOR BRAKE-VALVES. Elwin S. Lewis, Jr., Denver, Colo., assignor of one-half to Elwin S. Lewis, Sr., Denver, Colo. Filed Mar. 31, 1909. Contacts are arranged adjacent to the normal position of the valve handle and an alarm circuit is closed temporarily when the handle is moved so as to apply the brakes; the circuit is closed permanently when all the air stored in the brake system is applied to the brakes.

966,702. DOOR-SWITCH OPERATOR. Johann G. Peterson, Hartford, Conn., assignor to Arrow Electric Company, Hartford, Conn. Filed Nov. 3, 1909. The switch is set in the wall so as to leave a spring-pressed operating button projecting. On the corresponding place on the door is a socket containing a strong spring pushing a button outwardly through a face plate. On closing the door the latter button suddenly pushes the switch button.

966,703. ELECTRIC SAD-IRON. James W. Phelps, Detroit, Mich. Filed Oct. 21, 1909. A removable heating element is arranged between nonconducting plates.

966,705. SIGNALING BY WIRELESS TELEGRAPHY. Valdemar

Poulsen, Copenhagen, Denmark. Filed Mar. 8, 1907. Includes an electric arc, an oscillation circuit bridged across it and means for connecting and disconnecting an ohmic resistance with the circuit to absorb the energy thereof in the form of heat and prevent the transmission of oscillation therefrom.

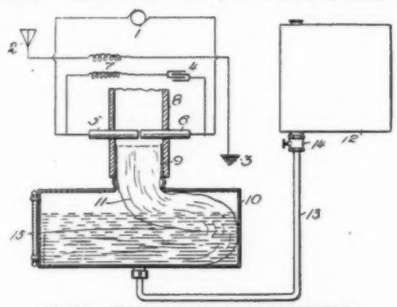
966,708. AUTOMATIC MAGNETIC CIRCUIT-BREAKER. William M. Scott, Philadelphia, Pa., assignor to Cutter Electrical & Manufacturing Company. Filed June 8, 1901. A device for ITE circuit-breakers that does not permit them to be closed during the continuance of abnormal electrical conditions.

966,728. TEST DEVICE. Arthur H. Adams, Antwerp, Belgium, assignor to Western Electric Company, Chicago, Ill. Filed May 31, 1907. A device for connecting conductors to a terminal block of a telephone distributing frame comprises a plate, means for detachably securing the plate to the frame, and a number of contacts arranged to engage corresponding terminals of the terminal block.

966,733. SERVICE-METER CIRCUIT FOR TELEPHONE-EXCHANGE SYSTEMS. Albert M. Bullard, New York, N. Y., assignor to Western Electric Company, Chicago, Ill. Filed Aug. 4, 1908. Combined with lines each having a marginal service meter associated therewith, and the terminal to which battery potential is applied through the meter is an operator's connecting device for making connection with any line terminal, sources of current of different polarity, a key for applying the same to operate the service meter of the line to which connection has been made, and polarized relay adapted automatically to select the source of current to be applied by the key.

966,737. REBOUNDING IGNITION AND SPACER DEVICE FOR EXPLOSIVE-ENGINES. Stephen Dudley Field, Stockbridge, Mass., assignor to Pittsfield Spark Coil Company, Dalton, Mass. Filed Nov. 20, 1907. Consists of a normally and freely balanced contact-lever, a pair of contact points, elastic means for normally maintaining the equilibrium of the lever and The contact points open, and an independently rotatable cam for periodically disturbing the equilibrium of the lever.

966,764. RELAY. Hermann Poser, Hermsdorf, near Berlin, Germany, assignor to Western Electric Company, Chicago, Ill. Filed Sept. 21, 1908. Combined with an electromagnet having two windings are a return pole piece, two L-shaped armatures mounted thereon, one within the other, one of the armatures being responsive to current in one winding and the other armature responsive to current in the other winding. A set of contacts is closed in response to one armature and opened in response to the second armature.



966,539.—WIRELESS TRANSMITTER.

966,766. SHORT-CIRCUIT DETECTOR. Frederick C. Reineking, Jersey City, N. J., assignor to Rankand Company. Filed Feb. 7, 1910. Mounted on an insulating handle are two longitudinal electrodes with an adjustable spark space between them. There are contacts connected to each electrode to permit touching opposite sides of the circuit to be tested. Over the spark space is a transparent cover.

966,768. CURRENT-CONTROLLING MECHANISM FOR INTERNAL-COMBUSTION ENGINES. Lewis T. Rhoades, Mont Clare, Pa. Filed Nov. 8, 1909. Keyed on a shaft so as to slide on it and turn with it is a member which brings two contacts together when it moves along the shaft in one direction.

966,783. MULTIPLE-FUSE CUT-OUT. Charles Almas, Toronto, Ontario, Canada. Filed Oct. 12, 1907. Contains a number of fusible wires so arranged that any desired number of them may be connected to carry current simultaneously to adapt the device to carry currents of different strength.

966,784. METHOD OF MANUFACTURING SPARK-PLUGS James C. Anderson, Washington, D. C. Filed Aug. 5, 1909. Consists in supporting and embracing the heated shell within a mold; heating an electrode and frictionally supporting it within the lower extremity of a compressing plunger; depositing a body of molten glass within the shell; and automatically locating the electrode with reference to the shell and welding the glass with the shell and electrode by causing the plunger to descend within the mold and upon the molten glass within the shell.

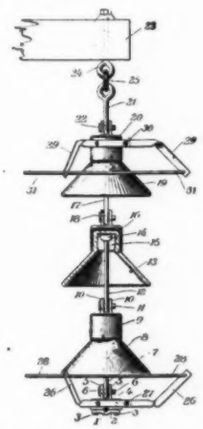
966,796. CAB SIGNAL SYSTEM. Pierre I. Chandeysson, St. Louis, Mo., assignor of one-half to Samuel W. Forder and W. Carver Forder, St. Louis, Mo. Filed Apr. 5, 1909. Comprises a normally closed electric circuit mounted on a train, a solenoid surrounding an axle thereof and a paramagnetic bar located in the track in co-operative relation to the solenoid.

966,799. CONDUIT-THREADING DEVICE. Frank Crawford, Pasadena, Cal., assignor to Conduit Threading Device Company, Pasadena, Cal. Filed Apr. 15, 1909. A reel for the wire is mounted on a frame. The wire is kept from uncoiling until the reel is rotated, when an automatic device releases the wire.

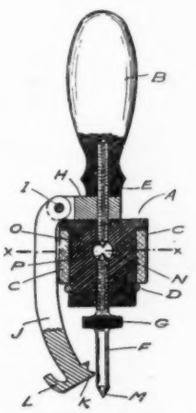
966,809. ELECTRIC SERVICE-METER. Oliver C. Dennis, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. Filed June 20, 1907. A telephone register is manually operated. A circuit independent of the talking apparatus disconnects the operating mechanism of the register.

966,812. INCANDESCENT LAMP. Charles I. Dodson, Pittsburg, Kans., assignor of one-fourth to Harry S. Clark, one-eighth to Archibald T. Cheatham, and one-eighth to Joseph Fletcher, Pittsburg, Kans. Filed Apr. 9, 1909. In a turn-down lamp with two filaments the socket shell is a common terminal for both and two separate concentric end contacts form the other terminals for the filaments.

966,822 to 966,825. ELECTRICAL SIGNALING SYSTEM. Albert Goldstein and Clark H. Pool, New York, N. Y., assignors to International Electric Protection Company. Filed Mar. 9, and Apr. 13, 1910. These four patents cover various features and modifications of an extensive alarm system having numerous stations.



966,584.—INSULATOR PROTECTOR.



966,766.—SHORT-CIRCUIT DETECTOR.

966,827. REELING-MACHINE. George Gustave, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. Filed Aug. 15, 1907. A frame carries a number of winding spools each driven by a shaft whose pinion engages a crown gear. A catch for maintaining each of the gears in engagement is controlled by an electromagnet governed by the tension of the wire being unwound from the spool.

966,839. BRUSH-HOLDER FOR DYNAMOS. Ernest C. Ketchum, Boston, Mass. Filed June 25, 1909. Two sets of insulated metal disks are mounted on the shaft. A series of supported rods carries brush-holders whose brushes connect the disks in series.

966,840. AUTOMATIC MERCURY-DROPPER. Ernest C. Ketchum, Boston, Mass. Filed June 25, 1909. In a dynamo means are provided for dropping mercury at the points of contact of the brushes and commutator.

966,846. ILLUMINATED SIGN. Lionel H. Moise, San Francisco, Cal. Filed Mar. 22, 1909. A highly reflecting letter surface stands out and away from a darker background. The lights are mounted in the letter, which has a margin differing in reflecting power from its main body.

966,847. TROLLEY-REPLACER. Dwight L. McBride and Harold A. Fiske, Pasadena, Cal. Filed Nov. 11, 1908. A lever near the trolley wheel carries the replacer which is controlled by air pressure.

966,855. ELECTROMAGNETIC SEPARATOR. Frank J. Phillips, Chicago, Ill. Filed Mar. 28, 1910. Consists of two pole-pieces each having a series of parallel tines. An electric energizing coil is wound over a core to which the pole-pieces are secured.

966,882. ATTACHMENT OF TELEGRAPH AND SIMILAR LINE WIRES TO INSULATORS. William Edward Bandfield, Wolverhampton, England. Filed Dec. 13, 1909. A U-shaped clip passes around the insulator and holds the wire in the U-shaped seats at its ends through which wire-retaining pins pass.

966,885. ELECTRO-AUTOMATIC NET-WEIGHT MACHINE. Charles L. Bond, Los Angeles, Cal. Filed Sept. 30, 1907. In a machine for weighing out definite equal amounts of a pulverized substance there is an electrically controlled means for cutting off the chute.

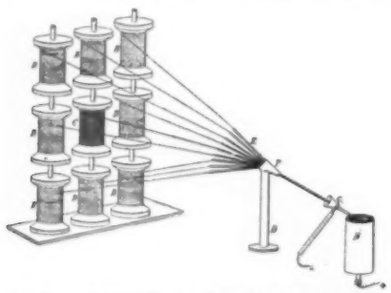
966,897. CENTRAL-ENERGY ALARM SYSTEM. John C. Francis, West New York, N. J., assignor to United Electric Protection Company. Filed Nov. 12, 1906. Combined with a grounded source of current is a line circuit, means actuated upon the occurrence of a crossing in the line for establishing current leads from the non-grounded pole of the source to the crossing, and a transmitter operating through the leads to actuate the alarm.

966,901. ALARM SYSTEM. Albert Goldstein, New York, N. Y., assignor to Electric Protection Company of New York. Filed Mar. 9, 1910. Includes two sources of courrent and a series of signal-transmitting devices.

966,902 and 966,903. ELECTRICAL SIGNALING SYSTEM. Albert Goldstein, New York, N. Y., assignor to International Electric Protection Company. Filed Mar. 28, 1910. Relates to further details of the system disclosed in patents 966,822 to 966,825.

966,904. TEMPERATURE ALARM DEVICE. Albert Goldstein, New York, N. Y., assignor to International Electric Protection Company. Filed Mar. 28, 1910. Comprises a pipe, an alarm actuated by impulses produced in the air therein, and insulated wire within the pipe, and an electrical alarm operated by short-circuiting between the wire and pipe.

966,917. INSULATING-CONDUIT FOR ELECTRIC WIRES OR CONDUCTORS. Anthony P. Hinsky, Brooklyn, N. Y. Filed Feb. 1, 1910. An armored conduit consists of fibrous strip folded so its edges abut and form a tube. Over the joint is laid a narrow strip also corrugated transversely. Around the whole is wound spirally a corrugated steel armoring strip.



967,084.—MAKING FILAMENT SUPPORTS.

966,965. MULTIPLE-PUNCH PRESS. Frank Thompson, Chicago, Ill. Filed Dec. 26, 1908. Electric contacts are arranged on each side of the pattern. When these come in contact through the perforations in the pattern circuits are closed for controlling the dies.

966,966. ELECTRIC-LAMP SOCKET AND SECURING MEANS THEREFOR. William C. Tregoning, Cleveland, Ohio, assignor to Tregoning Electric Manufacturing Company, Cleveland, Ohio. Filed Feb. 12, 1908. A porcelain socket with lugs fits into a mounting plate with recesses for the lugs. A circular locking plate holds the parts together.

966,996. THEATRICAL DEVICE. George A. Byrne, Washington, D. C. Filed Jan. 3, 1910. In a boxing exhibition the pugilists wear conducting garments and gloves and stand on plates connected to opposite terminals of a circuit. As the contest continues vicious sparking and flashing occurs between the fighters.

967,025. PHOTOGRAPHIC APPARATUS. John Leonard and William J. Oldaker, Chicago, Ill. Filed Sept. 24, 1907. The camera contains a transparent positive between the lens and the plate holder, also electric lamps and a lever which simultaneously moves the positive and governs the switch for the lights.

967,031. TROLLEY-WHEEL. Sylvester L. McAdams, Beaver Falls, Pa. Filed Oct. 16, 1909. Covers means for lubricating the spindle of the wheel.

967,051. ICE-CLEANER FOR TROLLEY-POLES. James C. Poe, Rosedale, Kans., assignor of one-half to C. M. Burdett and A. Champ, Kansas City, Mo. Filed Sept. 23, 1909. At the top of the pole is a fork-shaped arm carrying a toothed cutting wheel in front of the trolley wheel and a spring scraper between the two wheels.

967,058. ELECTRIC WATER-HEATER. Herbert N. Roche, San Francisco, Cal., assignor to Thomas B. Gray, San Francisco, Cal. Filed Dec. 21, 1909. Within a cylindrical chamber is a heating unit, a valve governing the flow of water and a switch.

967,059. RAILWAY-SWITCH-OPERATING MECHANISM. Elmer D. Rose, Marshburg, Pa. Filed May 14, 1909. An electrically operated track switch controlled by the motorman on the car.

967,084. PROCESS FOR MANUFACTURING THE HOOKS INTENDED TO SUPPORT THE FILAMENTS OF ELECTRIC INCANDESCENT LAMPS. Paul Gabriel Triquet, Paris, France, assignor to Perfectionnements aux Lampes a Filaments Metalliques, Societe Anonyme, Brussels, Belgium. Filed Feb. 4, 1910. A number of thin wires are drawn from bobbins about a thick wire and after passing through a funnel are soldered into a single wire by passing over an electrically heated soldering block.

967,113. COMBINED TELEPHONE AND ALARM OR KINDRED SERVICE SYSTEM. William W. Dean, Chicago, Ill., assignor to Consolidated Fire Alarm Company, New York, N. Y. Filed Apr. 30, 1903. In a common-battery telephone exchange there is an alarm receiving and registering apparatus connected to each line.

967,118. DEVICE FOR DETECTING WAVES IN WIRELESS TELEGRAPHY. George C. Ellwood, Arbuckle, Cal. Filed June 18, 1909. A three-point double-pole switch connects the terminals of the aerials to various inductances or one of them to ground.

967,133. SYSTEM OF MOTOR CONTROL. Samuel H. Keefer, Plainfield, N. J., assignor to Niles-Bement-Pond Company, Jersey City, N. J. Filed Nov. 8, 1909. An electromagnetically actuated reversing switch is provided with a blow-out magnet and a pilot switch for preventing operation of the reversing switch until the counter electromotive force of the motor falls to a low value.

REISSUE.

13,141. LIGHTNING-ARRESTER. Frank P. H. Knight, Keokuk, Iowa, assignor to Electric Service Supplies Company, Camden, N. J. Filed Jan. 5, 1910. Original No. 897,906, dated Sept. 8, 1908. Comprises a discharge path, a path for the line current, the relative impedance of the paths being such that the lightning discharge will never pass by way of the path for the normal current, and an automatic circuit breaker arranged in the path of the normal current and adapted when operated to completely open the circuit and again close it.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired August 15, 1910:

503,115. TEST SYSTEM FOR MULTIPLE SWITCHBOARDS. William D. Allison, Chicago, Ill.
503,132. BATTERY-JAR. Alvah M. Gee, Edgar, Neb.
503,157. SWITCH FOR ELECTRIC CIRCUITS. William McNeill and James H. Tinder, Winchester, Ky.
503,180. ELECTRIC SWITCH. Ernest P. Warner, Chicago, Ill.
503,183. ALTERNATING-CURRENT ELECTRIC MOTOR. Ferdinand A. Wessel, Boston, Mass.
503,186. ELECTRICAL CONDENSER. Alexander Wurts, Pittsburg, Pa.
503,187. FIRE-ALARM AND INDIVIDUAL ELECTRIC CALL. John Young, Chicago, Ill.
503,213. ELECTRICAL RECIPROCATING MOTOR. Henry S. McKay, Boston, Mass.
503,252. ELECTRIC SWITCHBOARD SIGNAL. Frank A. Pickernell, Newark, N. J.
503,279. CONTROLLING SWITCH FOR ELECTRICALLY-PROPELLED VEHICLES. Harry P. Davis, Pittsburg, Pa.
503,321. METHOD OF AND APPARATUS FOR THE TRANSMISSION OF ELECTRICAL ENERGY. Rudolph M. Hunter, Philadelphia, Pa.
503,349. INCANDESCENT LAMP SOCKET. Charles T. Lee, Boston, Mass.
503,372. TELEGRAPHIC APPARATUS. Albrecht Heil, Frankisch Crumbach, Germany.
503,384. CLEAT FOR ELECTRIC WIRES. Jacob Pawolowski, Cincinnati, Ohio.
503,415. ELECTRIC DRY CELL. Ramon Gabarro, Barcelona, Spain.
503,420. CLUTCH FOR ELECTRIC MOTORS. William A. Johnston and Arthur W. Browne, Prince's Bay, N. Y.
503,427. BINDING POST FOR ELECTRICAL CONNECTIONS. Arnold Kohl, Centralia, Ill.
503,443. TROLLEY-WIRE SWITCH. Elmer A. Sperry, Chicago, Ill.
503,445. METHOD OF WINDING COILS FOR DYNAMO-ELECTRIC ARMATURES. Elihu Thomson, Swampscott, Mass.
503,449. METHOD OF WINDING COILS FOR DYNAMO-ELECTRIC ARMATURES. John B. Blood, Lynn, Mass.
503,453. REGULATOR FOR ELECTRIC MOTORS. John C. Davidson, Prince's Bay, N. Y.
503,505. RAILWAY SIGNALING. Illius A. Timmis, London, England.
503,538 and 503,539. ELECTRIC-ARC LAMP. Louis E. Howard, Plainfield, N. J.
503,555. CABLING SYSTEM FOR MULTIPLE SWITCHBOARDS. Charles E. Scribner, Chicago, Ill.
503,562. ELECTRIC TROLLEY-WHEEL. John W. Clark, Menands, N. Y.
503,566. ELECTRICAL SUPPLY SYSTEM FOR RAILWAYS. Joseph W. Bates, Minneapolis, Minn.
503,487. ELECTRIC ENGINE. William Lawrence, New York, N. Y.
503,567. GALVANIC BATTERY. Charles H. Brown, Portland, Oreg.